Division of Air Quality Control

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

DIVISION OF AIR QUALITY CONTROL

1984

AIR QUALITY DATA REPORT

ONE WINTER STREET - 8TH FLOOR
BOSTON, MASSACHUSETTS 02108

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I. INTRODUCTION

This report presents 1984 annual air quality data for Massachusetts collected by the Division of Air Quality Control (DAQC), Department of Environmental Quality Engineering (DEQE). Data is collected by the Commonwealth and submitted to the U.S. Environmental Protection Agency (EPA) for inclusion into the National Aeromatic Data Bank in accordance with Regulations 40 CFR 58. DAQC has primary responsibility for measuring ambient air quality to verify compliance with state and national standards (see Table 1), to support development of regulations designed to reduce ambient air contaminants, to assess the effectiveness of existing air pollution control strategies, and to fulfill EPA reporting requirements for air quality data. Table 2 gives a brief description of the health and welfare effects of the six criteria air pollutants.

The continuous and non-continuous air monitoring stations both urban and rural are located throughout the state of Massachusetts. The stations are equipped with air pollution monitoring equipment (see Table 3) and, in some cases, meteorological equipment. The continuous state air pollution monitors record levels of ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and nitric oxide (NO). The non-continuous monitors record total suspended particulates (TSP), and lead (Pb.) Meteorological parameters measured in most instances include wind speed, wind direction, and temperature. Pollutant Standard Index for the regions within the state are recorded. The Commonwealth's ambient air monitoring network is complemented by a private network of monitors. This private network is limited to monitoring sulfur dioxide, sulfates (SO_4), total suspended particulates (TSP),wind-speed, wind direction and temperature.

Figures 2, 3, 5, 6, 7 and 9 illustrate the Commonwealth's public monitoring network maintainted by DAQC in 1984 for the six criteria pollutants. Figures 4, 8 and 11 illustrate the private monitoring network in 1984 for SO_2, SO_4, and TSP.

This year, DAQC collected a total of 502,765 hourly samples at the public sites and 819, 221 hourly samples at the private sites, for a total of 1,321,986(See Figure 1). This total represents an increase of 149,583 hourly samples over the total number for 1983 because mainly of an increase in data capture for the state network. PSI values are also calculated for the Regions within the state. This year, the Acid Precipitation Report is incorporated into this report.

Acid Precipitation is known to cause considerable damage to forests, and lakes. The state monitors the volume and acidity of precipitation at several locations in the state on both a daily and weekly basis. The Acid Precipitation monitoring network consists of four event (daily sampling) sites and three National Atmospheric Deposition Program (weekly sampling) sites.

The Commonwealth's data from public and private monitors have been summarized in this report for public record and information. For further information pertaining to this report and other related air quality problems, please contact either the Division of Air Quality Control at Boston at (617) 292-5630 or the Regional Offices.

AIR QUALITY REGIONAL SECTIONS

REGION 1 (Western)

John Higgins, REE

Stephen Joyce, DREE

David Howland, Chief-AQC

436 Dwight St.

Springfield, MA 01101

(413) 785-5327

REGION 3 (Metropolitan/Northeast)

Richard Chaplin, Acting REE

Michael Maher, Chief-AQC

5 Commonwealth Avenue

Woburn, MA 01801

(617) 935-2160

REGION 2 (Central)

Gilbert Joly, REE

Edmond Benoit, DREE

Thomas Cusson, Chief-AQC

75 Grove St.

Worcester, MA 01605

(617) 791-3672

REGION 4 (Southeast)

Paul Anderson, REE

Robert Donovan, DREE

Vaughan Steeves, Chief-AQC

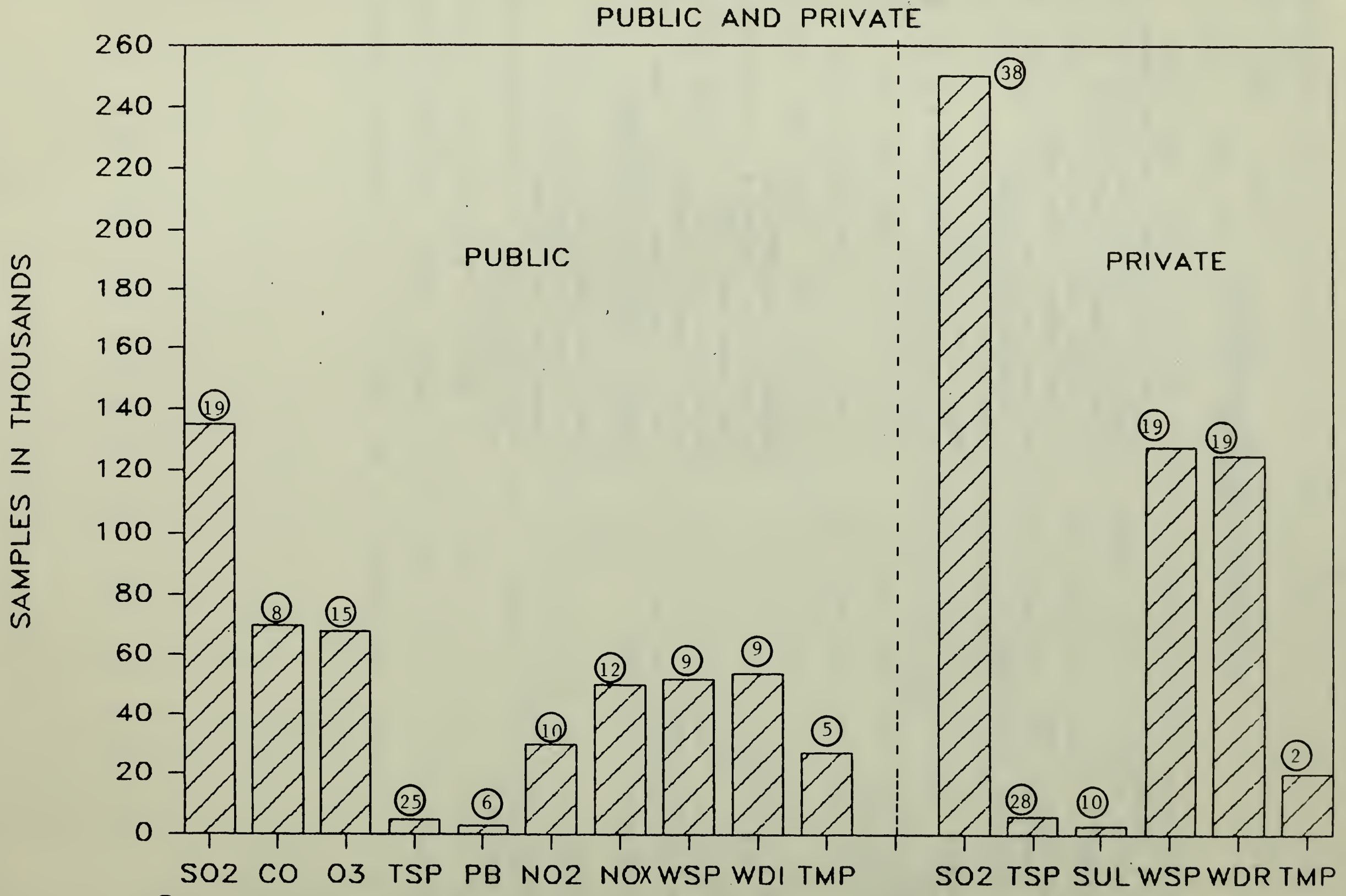
Lakeville Hospital

Lakeville, MA 02346

(617) 947-1231

FIGURE 1 :

SAMPLES FOR MONITORING SITES 1984



◯ = Number of Monitoring Sites
SO2 = Sulfur Dioxide
CO = Carbon Monoxide
O3 = Ozone

TSP = Total Suspended Particulates
PB = Lead
NO2 = Nitrogen Dioxide
NOX = Nitric Oxides

WSP = Wind Speed
WDI = Wind Direction
TMP = Temperature
SUL = Sulfates

FIGURE 2: AIR POLLUTION CONTROL REGIONS

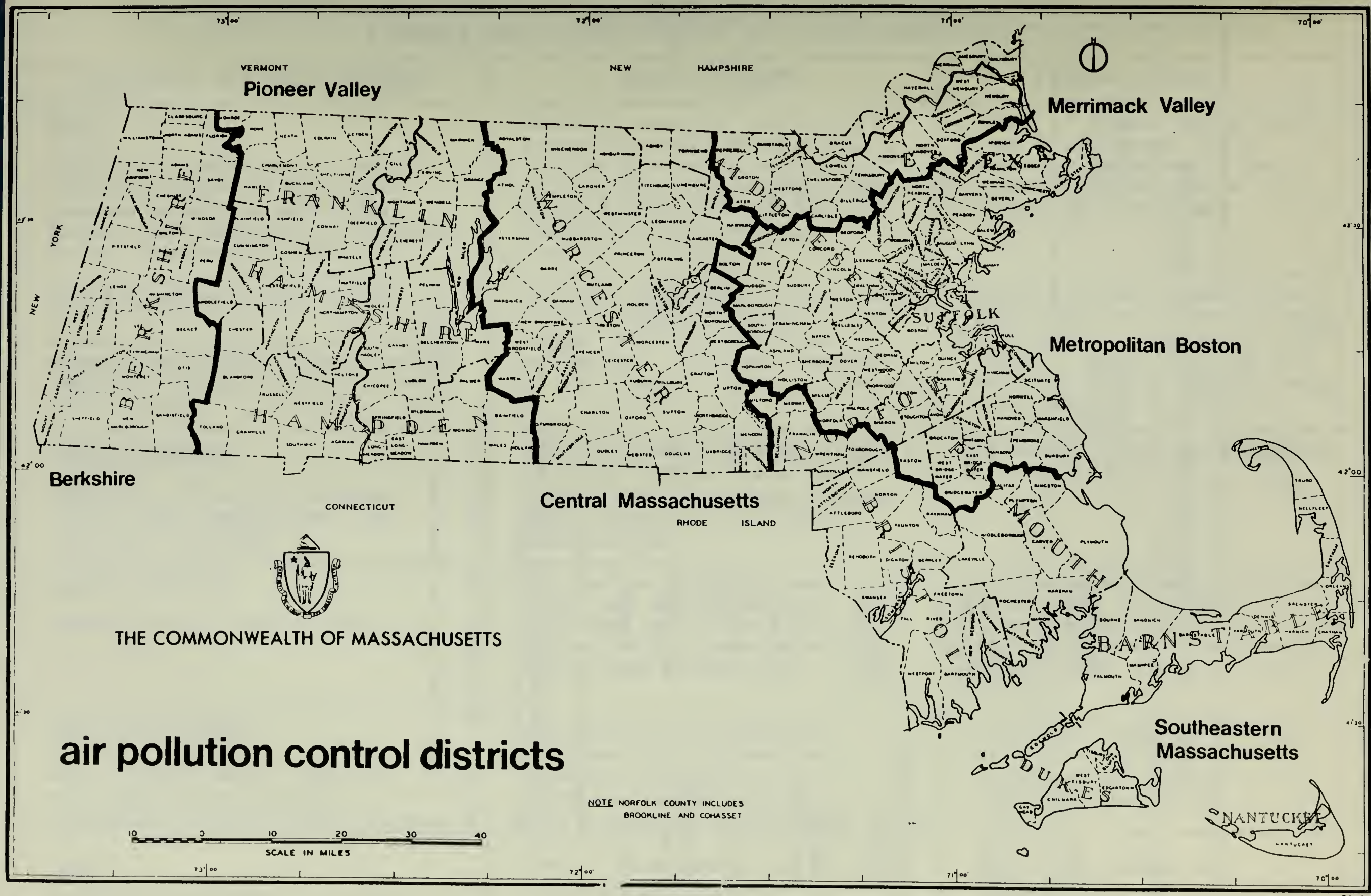


TABLE 1

STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING INTERVAL	PRIMARY STANDARD ug/m^3	PRIMARY STANDARD ppm	SECONDARY STANDARD ug/m^3	SECONDARY STANDARD ppm
Sulfur Dioxide	Annually	80	0.03	-	-
	24 hour	365	0.14	-	-
	3 hour	-	-	1,300	0.5
Particulate Matter	Annually	75	-	60**	-
	24 hour	260	-	150	-
Carbon Monoxide	8 hour	10*	9	10*	9
	1 hour	40*	35	40*	35
Ozone	1 hour	240	0.12	240	0.12
Nitrogen Dioxide	Annually	100	0.05	100	0.05
Lead	3 month	1.5	-	1.5	-

ug/m^3 - micrograms per cubic meter
ppm - parts per million

*mg/m^3 - milligram per cubic meter

** annual average is considered a guideline

TABLE 2

HEALTH AND WELFARE EFFECTS OF AIR POLLUTANTS

POLLUTANTS AND THEIR SOURCES	HEALTH EFFECTS	WELFARE EFFECTS
Ozone Product of reactions of motor vehicle exhaust, industrial process emissions and other fossil fuel combustion emissions in the presence of sunlight.	Causes breathing difficulty, especially when exercising, irritates eyes, respiratory infections. Acute exposures cause bronchoconstriction, lung edema and abnormal lung development.	Toxic to plants by causing both leaf damage and a decrease in growth. Can weaken materials such as rubber and fabrics.
Total Suspended Particulates Fossil fuel burning, industrial process emissions, motor vehicle exhaust, traffic movement over dusty roads.	Critical for those with chronic lung diseases, can alter the lungs' natural cleansing mechanism. They are composed of or adhere to toxic materials.	Cause soiling of materials, are corrosive and can damage buildings. Causes haze which reduces visibility and the amount of solar energy reach-the earth.
Carbon Monoxide Internal combustion engines, fossil fuel combustion, and cigarette smoking.	Reduces the blood's ability to carry oxygen which may cause heart and brain damage. Acute exposures can cause asphyxiation.	No known effect on materials or vegetation.
Sulfur Dioxide Combustion of fossil fuel.	Irritation of throat and lungs and aggravation of symptoms among those with chronic lung diseases such as asthma and bronchitis.	Corrosion and deterioration of metals, brittleness of paper, discoloration of paint and deterioration of fabric. Causes leaf damage to some plants.
Nitrogen Dioxide Emitted from motor vehicles and fossil fuel burning operations such as power plants.	Aggravation of symptoms in those with asthma and chronic bronchitis and increased susceptibility to respiratory infections.	Fading of dyes, yellowing of leaves on plants, and changing the horizon to a reddish brown color.
Lead Emitted from motor vehicle exhausts and smelters.	Mental retardation, brain and other organ damage.	No direct impact on vegetation.

TABLE 3

ANALYSIS COLLECTION METHOD LISTING*

Sulfur Dioxide:
- 14 Coulometric
- 20 Pulse Fluorescent Instrumental

Carbon Monoxide:
- 11 Non-Dispersive Infra-Red Instrumental
- 14 Ultraviolet Photometric

Ozone:
- 11 Chemiluminescence Instrumental

Nitrogen Dioxide:
- 14 Chemiluminescence Instrumental

Total Suspended Particulates:
- 92 High Volume Air Sampler

Lead:
- 92 High Volume Air Sampler

* Corresponds To Data Summary: Instrument Method

TABLE 4 LIST OF EXCEEDANCES - PUBLIC SITES 1984

POLLUTANT	LOCATION	AQCR	ADDRESS	SAROAD	MO.	DAY	TIME	LEVEL REACHED
CARBON MONOXIDE	Boston	Met. Boston	Essex St.	0240-022	Nov	26	1200-1900	13 mg/m^3
(8 Hour Average)					Dec	10	1500-	12 mg/m^3
	Lowell	Merrimack Valley	Merrimack St.	1080-007	Jan	23	1600-2300	12 mg/m^3
					Feb	02	1600-2300	13 mg/m^3
					Feb	03	300-1100	11 mg/m^3
					Nov	26	1600-2300	15 mg/m^3
					Nov	27	1600-2300	12 mg/m^3
	Worcester	Central Mass.	Thomas St.	2640-020				
					Jan	23	1600-2300	14 mg/m^3
					Feb	13	400-1100	12 mg/m^3
	Springfield	Pioneer Valley	E. Columbus Ave.	2160-007	Jan	24	1600-2300	13 mg/m^3
					Jan	05	1600-2300	12 mg/m^3
(One Hour Average)	N O E X C E E D A N C E S R E C O R D E D							
NITROGEN DIOXIDE (Annual)	N O E X C E E D A N C E S R E C O R D E D							
LEAD (Quarterly)	N O E X C E E D A N C E S R E C O R D E D							
TSP (Annual)	N O E X C E E D A N C E S R E C O R D E D							
(24 Hour Average)	N O E X C E E D A N C E S R E C O R D E D							
SO_2 (Annual)	N O E X C E E D A N C E S R E C O R D E D							
(24 Hour Average)	N O E X C E E D A N C E S R E C O R D E D							
(3 Hour Average)	N O E X C E E D A N C E S R E C O R D E D							

TABLE 4 LIST OF EXCEEDANCES - PUBLIC SITES 1984 (Cont.)

POLLUTANT	LOCATION	AQCR	ADDRESS	SAROAD	MO.	DAY	TIME	LEVEL REACHED
OZONE	Agawam	Pioneer Valley 042	152 Westfield	0030-003	April	29	1600	.129
					June	08	1900	.139
					July	15	1700	.144
					July	16	2300	.133
					July	17	0100	.141
	Amherst	Pioneer Valley	Solar Habitat Exp House	0060-002	June	27	1800	.125
					July	10	1800	.125
	Chicopee	Pioneer Valley	Anderson Rd Westover AFB	0400-008	June	08	1900	.209
					July	04	1500	.133
					July	10	1700	.130
					July	15	1700	.168
	Ware	Pioneer Valley	Ware High School	2360-001	May	25	1600	.130
					May	26	1500	.127
					June	08	1700	.204
					June	27	1700	.150
					July	04	1300	.135
					Aug.	22	1900	.131
	Worcester	Central Mass.	DPW Yard Belmont Ave.	2640-019	June	27	1700	.146
					July	15	1700	.138
	Chelsea	Met. Boston	Power Horn Hill	0380-003	July	15	1800	.125
					Sept	25	0900	.125
	Medfield	Met. Boston	Rt. 27 N. Meadow St. Hospital	1210-001	July	15	1700	.144
					Aug.	01	2000	.145
	Sudbury	Met. Boston	Watertown Rd National Wildlife	2196-001	June	27	1800	.125
					July	15	1800	.165
					Aug.	01	2100	.128
					Aug.	03	1500	.125
					Aug.	22	1800	.147
					Sept	20	1700	.136

TABLE 4 LIST OF EXCEEDANCES - PUBLIC SITES 1984 (Cont.)

POLLUTANT	LOCATION	AQCR	ADDRESS	SAROAD	MO.	DAY	TIME	LEVEL REACHED
OZONE	Attleboro	Southeast Mass.	532 Newport Ave.	0120-004	June	07	1400	.125
					June	11	1600	.130
					July	15	1600	.144
					Aug.	01	1700	.141
	N. Easton	Southeast Mass.	300 Main St.	0535-001	July	14	1800	.128
					July	15	1600	.133
					Aug.	03	1200	.151
					Aug.	22	1500	.125
	Fairhaven	Southeast Mass.	Leroy Wood School	0570-002	June	05	2000	.125
					June	07	1600	.157
					June	08	1800	.153
					June	09	1100	.133
					June	10	2000	.145
					June	11	1500	.161
					July	14	1600	.206
					Aug.	01	1200	.125
					Aug.	22	1300	.126
	Newburyport	Merrimack Valley	NWR.HQ Plum Island	1520-003	June	07	1500	.136

II. PUBLIC SITE DIRECTORY - 1984

ITY ITE LOCATION	SAROAD #	UTM COORD EAST NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	CO	O_3	NO_2	TSP	Pb
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)										
gawam 152 South West-field St.	0030-003	6961200 46590400	3	Rural Agri-culture			X			
mherst Solar Habitat	0060-002	704310 4690600	3	Rural - Agricultural			X			
nicopee Anderson Rd. Westover	0400-008	701800 4674200	3	Suburban - Commercial	X		X	X		
olyoke 1 Court Square	0860-007	697480 4674500	12	Center City-Commercial					X	
pringfield 1586 E. Columbus Ave.	2160-007	698000 4662000	7	Center City-Industrial		X				X
pringfield Longhill Ave (Substations)	2160-009	700000 4661928	6	Center City-Commercial	X					
pringfield 59 Howard St. School	2160-011	699460 4663380	19	Center City-Commercial					X	X
pringfield Fernbank St.	2160-014	707080 4668200	4	Suburban - Commercial		X				
pringfield Community Tech. College	2160-015	3264620 47043850	5	Center City-Residential	X			X	X	
are Rt. 32 (Ware High School)	2360-001	725850 4680900	4	Suburban - Commercial			X			
est Springfield Van Deene St.	2475-003	696400 4663940	7	Suburban - Commercial					X	

II. PUBLIC SITE DIRECTORY - 1984 Con't.

CITY SITE LOCATION	SAROAD #	UTM COORD EAST NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	CO	O_3	NO_2	TSP	Pb
BERKSHIRE AIR QUALITY CONTROL REGION (117										
Pittsfield Roof of Berkshire Commons	1800-006	643500 / 4699897	11	Center City Commercial				X		
Pittsburg Birchgrove Drive	1800-007	646480 / 4700620	3	Suburban Commercial	X		X			
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)										
Fitchburg Summer St. Substation	0620-003	271500 / 4716800	5	Center City Industrial	X					
Fitchburg 5 Summer St.	0620-010	2710000 / 4717230	18	Center City Commercial	X					
Warren River St. Regional High School	2372-001	732000 / 4677900	5	Rural - Agricultural				X		
Worcester 419 Belmont St. Health Dept.	2640-013	272400 / 4683700	5	Center City Residential				X		
Worcester 2 Washington St. YWCA	2640-016	269100 / 4682200	13	Center City Commercial				X	X	
Worcester Grove St. Voc. Tech. Sch.	2640-018	269100 / 4683750	10	Center City Commercial				X		
Worcester DPW Yard, Belmont Ave.	2640-019	272300 / 4683750	4	Center City Residential	X		X	X		
Worcester Thomas St. Fire Station	2640-020	269200 / 4683100	3	Center City Commercial	X	X				
Worcester 26 Salisbury St.	2640-021	2691000 / 46831000	9	Center City Commercial				X		

II. PUBLIC SITE DIRECTORY - 1984 Con't.

ITY ITE LOCATION	SAROAD #	UTM COORD EAST NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	CO	O_3	NO_2	TSP	Pb
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)										
oston Kenmore Square 590 Comm. Ave.	0240-002	327100 4690400	5	Center City Commercial	X	X		X		X
oston Southampton St. Fire HQ	0240-012	329580 4688230	14	Center City Commercial					X	
oston Kneeland St. Parking Lot	0240-015	330000 4690000	3	Center City	X	X				
oston 340 Breman St. E. Boston	0240-021	330000 4693550	3	Center City Residential	X	X	X	X	X	
oston Essex St.	0240-022	330100 4690750	3	Center City Commercial		X				
oston 200 Columbus Ave.	0240-024	329400 4690350	10	Center City Commercial					X	X
oston Deer Island	0240-026	337900 4690200	4	Suburban Residential	X			X		
rockton Crescent St., Paine School	0320-003	333300 4660400	14	Center City Industrial					X	
helsea Chestnut and 6th St.	0380-002	332500 4695100	16	Center City Commercial					X	X
helsea Power Horn Hill	0380-003	3399000 46961500	19	Center City Residential	X		X	X		
edfield Rt. 27 N. Meadow State Hospital	1210-001	307200 4675800	24	Rural Commercial	X		X		X	
edford 100-120 Main St. Fire HQ	1220-002	326300 4697990	7	Center City Commercial					X	

II. PUBLIC SITE DIRECTORY - 1984 Con't.

CITY SITE LOCATION	SAROAD #	UTM COORD EAST NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	CO	O_3	NO_2	TSP	Pb
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119) (Cont.)										
Quincy Hancock St., Atlantic Fire Station	1880-007	332400 4682100	3	Suburban Residential					X	
Sudbury Watertown Rd. Natl. Wildlife	2196-001	303350 4695100	5	Rural Agricultural			X			
Watertown Victory Field	2380-005	3203100 46935000	4	Center City Residential	X					
Woburn Pleasant St. Court House	2620-002	323000 4705000	12	Suburban Commercial					X	
MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)										
Lawrence 1 General St. Hospital	1000-003	3240000 4730500	25	Center City Industrial					X	
Lawrence High St. Storrow Park	1000-005	342220 4730590	4	Center City Residential	X		X	X	X	
Lowell 35 YMCA Drive	1080-006	310370 4722640	7	Center City Commercial		X			X	X
Lowell Old City Hall Merrimack St.	1080-007	310400 4723800	5	Center City Commercial	X	X				
Newburyport NWR H Quarters Plum Island	1520-003	351300 4741600	4	Suburban Residential			X			
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)										
Attleboro 532 Newport Ave.	0120-004	000000 000000	13	Suburban Residential			X			
Easton-North 300 Main St. Post Office	0535-001	327050 4659170	5	Rural Near Urban			X			

II. PUBLIC SITE DIRECTORY - 1984 Con't.

ITY ITE LOCATION	SAROAD #	UTM COORD EAST NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	CO	O_3	NO_2	TSP	Pb
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120) (Cont.)										
airhaven Leroy Wood School	0570-002	343330 4610800	4	Suburban Residential	X		X	X		
all River 165 Bedford St.	0580-001	321000 4618000	15	Center City Commercial					X	
all River Globe St.	0580-004	319700 4616900	5	Center City Commercial	X			X		
ew Bedford 234 Earle St.	1500-003	-	14	Center City Commercial					X	
ew Bedford 25 Water St. YMCA	1500-004	3395000 46101100	16	Center City Commercial					X	

II. PRIVATE SITE DIRECTORY - 1984

SITE LOCATION	SAROAD #	UTM COORD EAST/ NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	SO_4	W/S	W/D	TSP	Temp
PIONEER VALLEY AIR QUALITY CONTROL REGION										
ıicopee Grattan & Meadow	0400-006	6970690 / 46726150	5	Suburban		X			X	
:ving Route 2 North	0540-001	7146000 / 47198100	3	Rural	X					
·ving Route 2 N. East	0540-002	7150200 / 47200300	3	Rural Industrial	X					
:ving Route 2 Fire Station	0540-003	-	8	Rural	X					
·ving Rt. 2 West	0540-004	7145000 / 47192400	16	Rural			X	X		
ıdley Russell St. Hopkin Academy	0789-001	6893980 / 46902140	3	Suburban	X					
ıdley Summit Hse, Mt. Holyoke	0789-002	6291600 / 46859710	5	Rural	X		X	X		
›lyoke Mt. Tom Power Plant	0860-005	6975540 / 46830120	3	Rural	X		X	X	X	
›lyoke Mt. Tom Ski Area	0860-008	6954000 / 46801000	4	Suburban	X					
›lyoke Goat Pk. Mt. Tom Reservation	0860-009	6954000 / 46825000	5	Suburban	X		X	X	X	
›lyoke Chmura Pool, Anniversary Park	0860-010	6972000 / 46756800	3	Center City	X		X	X		
›rthampton Ziskind Hall, Smith College	1600-002	6954000 / 46825000	12	Center City					X	
›rthampton Elm St. Smith College	1600-003	6946600 / 46877900	11	Center City		X			X	

II. PRIVATE SITE DIRECTORY - 1984 Con't.

SITE LOCATION	SAROAD #	UTM COORD EAST/ NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	SO_4	W/S	W/D	TSP	Temp
PIONEER VALLEY AIR QUALITY CONTROL REGION (Cont.)										
South Hadley Pine St. Sub-Station	2126-002	6990120 / 46796870	3	Suburban	X				X	
South Hadley 23 Granview St.	2126-003	6994000 / 46766000	3	Suburban	X		X	X		
South Hadley Skinner Ste. Pk.	2120-004	6984000 / 46853000	13	Rural	X					
Springfield Longhill Sub-Station	2160-009	7001930 / 46619280	6	Center City	X	X			X	
Springfield Carew St. Sub-Station	2160-010	6998550 / 46664150	4	Suburban	X					
Springfield Civic Center Rooftop	2160-012	6994620 / 46636920	21	Center City		X			X	
Springfield Rose St. & Page Blvd.	2160-013	7023460 / 46683460	5	Center City		X			X	
W. Springfield 15 Agawam St. Power Plant	2475-002	6986390 / 46628670	4	Center City	X					
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION										
Fitchburg 5 Summer St.	0620-010	2710000 / 47172300	18	Center City	X		X	X	X	
Leominster 145 Lancaster St Civil Defense	1040-001	2723500 / 47109000	-	Center City					X	
Leominster 365 Lindell St. July County School Bd.	1040-002	2723000 / 47140000	-	Suburban					X	

II. PRIVATE SITE DIRECTORY - 1984 Con't.

SITE LOCATION	SAROAD #	UTM COORD EAST/ NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	SO_4	W/S	W/D	TSP	Temp
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION										
Beverly E. Lothrop St. Central Cemetry	0220-002	3466000 4712400	3	Center City	X				X	
Boston 476 Atlantic Ave	0240-018	3307600 4690790	3	Center City	X	X			X	
Boston Long Island	0240-019	3375950 4686595	5	Rural	X	X	X	X	X	
Boston Dewar St. Dorchester	0240-020	3305480 4685952	6	Center City	X	X	X	X	X	
Boston Breman St. E. Boston	0240-021	3326960 4693440	3	Center City	X	X	X	X	X	
Danvers 154 Andover St.	0480-003	3382000 4713300	-	Suburban	X		X	X	X	
Lynn 436 Lynnway St. GECO	1100-003	3391710 4701463	-	Center City	X		X	X		
Marblehead Green St.	1160-003	3473950 4707922	3	Suburban	X					
Peabody Meadow Pond - Glen Rd.	1780-004	3413400 4708630	3	Suburban	X		X	X		
Peabody X Hill - Perkins St. Playground	1780-005	3411300 4709640	3	Suburban	X		X	X		
Salem Fort Ave. Power Transm. Lines. NEPC	1980-004	3459000 4710100	3	Suburban	X		X	X	X	X
Salem Fort Ave. Cart Cove Marine Lab	1980-005	3462500 4710000	3	Suburban	X				X	

II. PRIVATE SITE DIRECTORY - 1984 Con't.

SITE LOCATION	SAROAD #	UTM COORD EAST/ NORTH	REC HGT (M)	STATION TYPE	POLLUTANTS SAMPLED SO_2	SO_4	W/S	W/D	TSP	Temp
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (Cont.)										
Salem Derby St.	1980-006	-	3	Suburban	X				X	
Sherbon Perry St. Power Lines	2042-001	3022000 / 46812000	2	Rural	X	X			X	
Stoneham Hill St. Hillside Garden Apts.	2180-001	3264620 / 47043850	12	Suburban	X		X	X		
Wellesley Whitin Obs. Wellesley College	2420-001	3101500 / 46847800	4	Suburban	X				X	
SOUTHEAST MASSACHUSETTS AIR QUALITY CONTROL REGION										
Fall River Globe & Wilcox St.	0580-010	3189600 / 46172300	3	Center City	X					
Fall River Highland Ave.	0580-012	3233300 / 46227950	4	Suburban	X		X	X		
Fall River Highland Ave. Truesdale Hosp.	0580-013	3224150 / 46215740	8	Suburban	X		X	X	X	
Fall River Stanley St.	0580-036	3222500 / 46200500	4	Center City	X				X	
Somerset Riverside Ave.	2080-002	3212880 / 46223590	18	Suburban					X	
Swansea Sharp Lots Rd.	2230-001	3173000 / 46246000	3	Suburban	X		X	X	X	X
MERRIMACK VALLEY AIR QUALITY CONTROL REGION										
Pepperell 12 Bennet St.	1792-001	2888540 / 47262750	3	Rural	X		X	X		

III. SAMPLING RESULTS FOR AIR QUALITY DATA

A. Sulfur Dioxide (SO_2)

1. Sampling Method

The instrumental method used to analyze continuous SO_2 concentrations is pulse fluorescent. In the pulse fluorescent method, SO_2 molecules are excited by ultra-violet light. In the process, the molecules emit distinctive light waves which vary in intensity according to the SO_2 concentration. The intensity is then measured to find specific SO_2 concentrations. The sampling method meets the equivalency requirements published by the U.S. Environmental Protection Agency in Part 58, 40 CFR, May 10, 1979.

2. Summary of Data

In 1984, there were 19 state-operated SO_2 monitors--an increase of one monitor from 1983 (Figure 3). Sixteen of these sites operated in 1984 at 75 percent or greater for data capture. There were no recorded violations of the National Ambient Air Quality Standards (NAAQS) for SO_2 in 1984. Table 5 shows that the highest annual average is in the Metropolitan Boston urban area.

There were 38 privately-operated SO_2 monitors for 1984 (Figure 4). Thirty one of these sites operated at 75 percent or greater for data capture. There were no recorded violations of the NAAQS. Table 6 shows that the highest annual average is in the Metropolitan Boston area.

(3) TABLE 5 - PUBLIC SITES

1984 SULFUR DIOXIDE MONITORING RESULTS

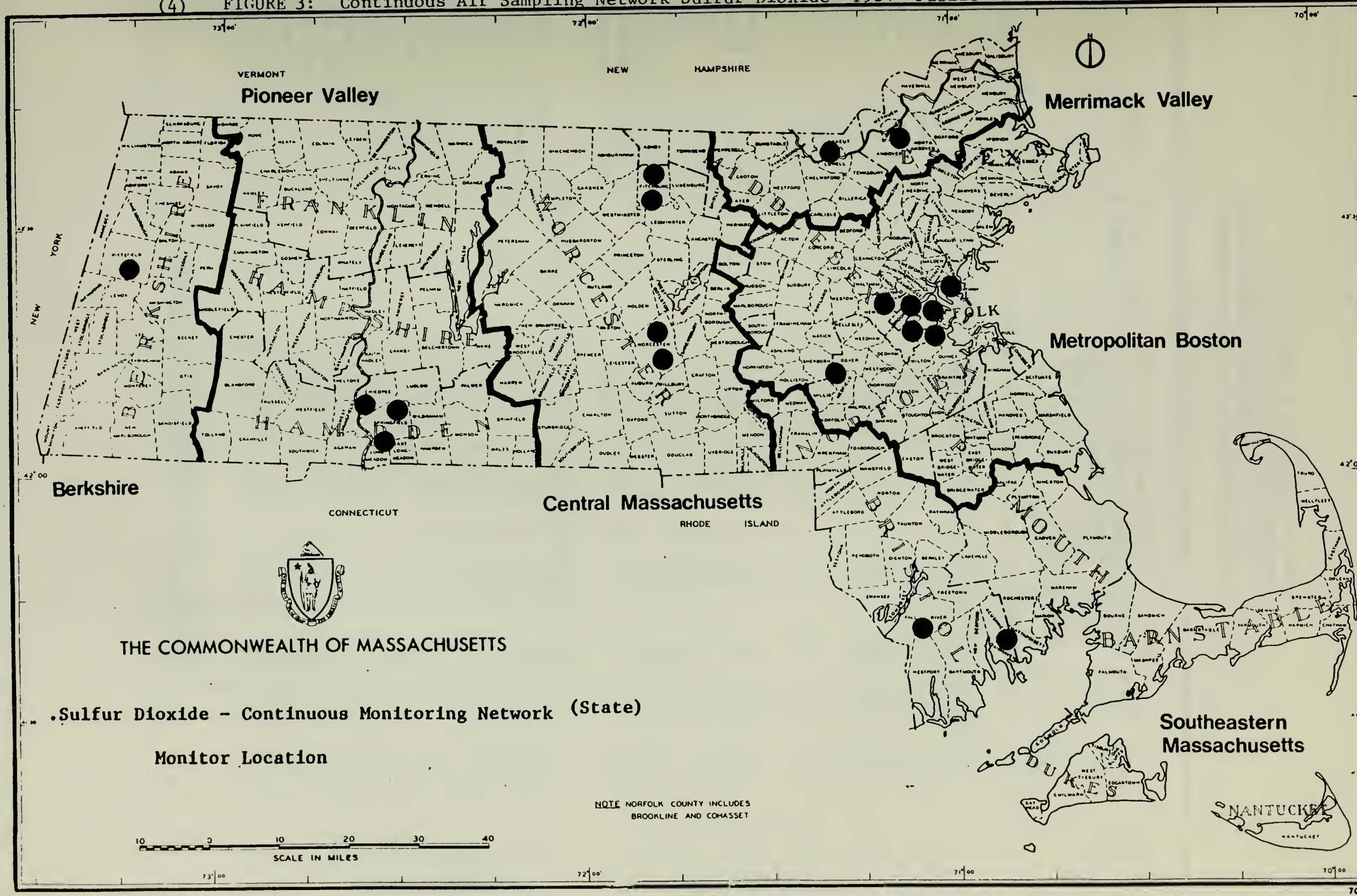
SO_2 units: ug/m^3

City	Saroad #	Instrument Method	Number of Hourly obs.	Annual Arith. Mean	Maximum Daily obs 1st 24hr	Maximum Daily obs 2nd 24hr	Maximum 3 Hr obs Block 1st	Maximum 3 Hr obs Block 2nd	Max 1 obs.	2d mx h os
BERKSHIRE AIR QUALITY CONTROL REGION										
Pitts-field	1800-007	20	7541	25	128	118	231	218	380	26
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION										
Fitchburg	0620-003	20	5829**	*	145	124	249	235	346	34
Fitchburg	0620-010	20	1328**	*	84	50	124	110	152	13
Worcester	2640-019	20	8418	15	102	93	151	148	252	15
Worcester	2640-020	20	8140	23	170	145	266	259	314	31
MERRIMACK VALLEY AIR QUALITY CONTROL REGION										
Lawrence	1000-005	20	8190	30	163	154	424	267	529	47
Lowell	1080-007	20	8375	25	112	108	190	169	233	22
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION										
Boston	0240-002	20	7963	43	193	191	278	265	464	33
Boston	0240-015	20	8433	32	171	146	297	279	461	38
Boston	0240-021	20	8006	34	171	141	279	261	343	29
Boston	0240-026	20	895**	*	120	114	198	187	217	21
Chelsea	0380-003	20	7155	24	109	102	367	263	524	45
Medfield	1210-001	20	8227	13	95	90	124	122	178	14
Watertown	2380-005	20	8043	23	172	126	252	246	309	27
PIONEER VALLEY AIR QUALITY CONTROL REGION										
Chicopee	0400-008	20	7752	21	152	129	240	201	314	30
Springfield	2160-009	20	8023	28	162	153	258	245	288	28
Springfield	2160-015	20	8093	31	228	179	307	277	314	31
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION										
Fairhaven	0570-002	20	7806	16	109	99	164	152	262	26
Fall River	0580-004	20	8338	28	182	131	270	242	456	36

* Annual Arithmetic Mean could not be determined due to insufficient sample size.

** When total observations are less than 6,250, sample size is insufficient to represent sound data results for the year. Sulfur dioxide data are collected throughout the year; 100 percent data capture during this period represents 8,760 hourly observations.

(4) FIGURE 3: Continuous Air Sampling Network Sulfur Dioxide 1984 Public Sites



(5) TABLE 6 - PRIVATE SITES

1984 SULFUR DIOXIDE MONITORING RESULTS

SO_2 units: ug/m^3

City	Saroad #	Instrument Method	Number of Hourly obs.	Annual Arith. Mean	Daily Maximum 1st 24HR	Daily Maximum 2nd 24HR	Daily Max 3HR obs. Block 1st	Daily Max 3HR obs. Block 2nd	Daily Max 1HR obs.	Daily 2nd Max 1HR obs
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION										
Beverly	0220-002	16	8621	13	223	139	445	314	506	453
Boston	0240-018	20	8381	35	168	134	288	288	304	288
Boston	0240-019	20	8136	19	254	238	236	210	288	236
Boston	0240-020	20	8391	29	178	170	341	288	495	362
Boston	0240-021	20	8401	37	183	136	498	314	1001	333
Danvers	0480-003	20	8675	21	94	79	314	262	634	459
Lynn	1100-003	91	6451	QA	--	--	--	--	--	--
Marble-head	1160-003	16	8727	25	181	131	451	445	495	485
	-	-	-	-	-	-	-	-	-	
Peabody	1780-004	16	8762	31	118	89	283	189	348	317
Peabody	1780-005	16	8754	35	162	160	328	325	532	409
Salem	1980-004	16	8723	22	131	123	388	364	1114	422
Salem	1980-005	16	8713	16	128	73	236	183	236	225
Salem	1980-006	16	141**	*	241	155	157	131	1410	110
Sherborn	2042-001	13	7252	8	79	42	210	343	343	328
Stoneham	2180-001	20	8573	37	141	128	262	330	330	320
Wellesley	2420-001	20	8011	21	113	107	314	236	325	257
PIONEER VALLEY AIR QUALITY CONTROL REGION										
Erving	0540-001	20	7496	24	84	79	288	210	511	469
Erving	0540-002	20	6416	24	144	128	629	498	817	757
Erving	0540-003	20	7539	11	66	50	183	157	272	215
Hadley	0789-001	16	7914	32	162	89	291	288	354	288
Hadley	0789-002	16	7738	30	183	105	472	348	692	587
Holyoke	0860-005	16	7928	29	92	84	241	231	312	272
Holyoke	0860-008	16	312**	*	72	64	144	107	168	152
Holyoke	0860-009	16	314**	*	85	72	126	121	202	115
Holyoke	0860-010	20	7954	21	115	100	210	210	262	191
S. Hadley	2126-002	20	7930	33	165	113	312	275	346	341
S. Hadley	2126-003	20	8284	13	134	50	367	183	427	291
S. Hadley	2126-004	20	203**	*	102	100	131	131	141	139
Springfld	2160-009	16	8314	40	201	100	257	249	314	286
Springfld	2160-010	16	8334	39	244	207	388	369	424	388
W.Spring-field	2475-002	16	8336	35	181	94	244	238	288	270
CENTRAL MASSACHUSETTS AIR QUALITY										
Fitchburg	0620-010	20	4144**	*	168	89	314	288	338	322

(5) TABLE 6 - PRIVATE SITES

1984 SULFUR DIOXIDE MONITORING RESULTS

SO_2 units: ug/m3

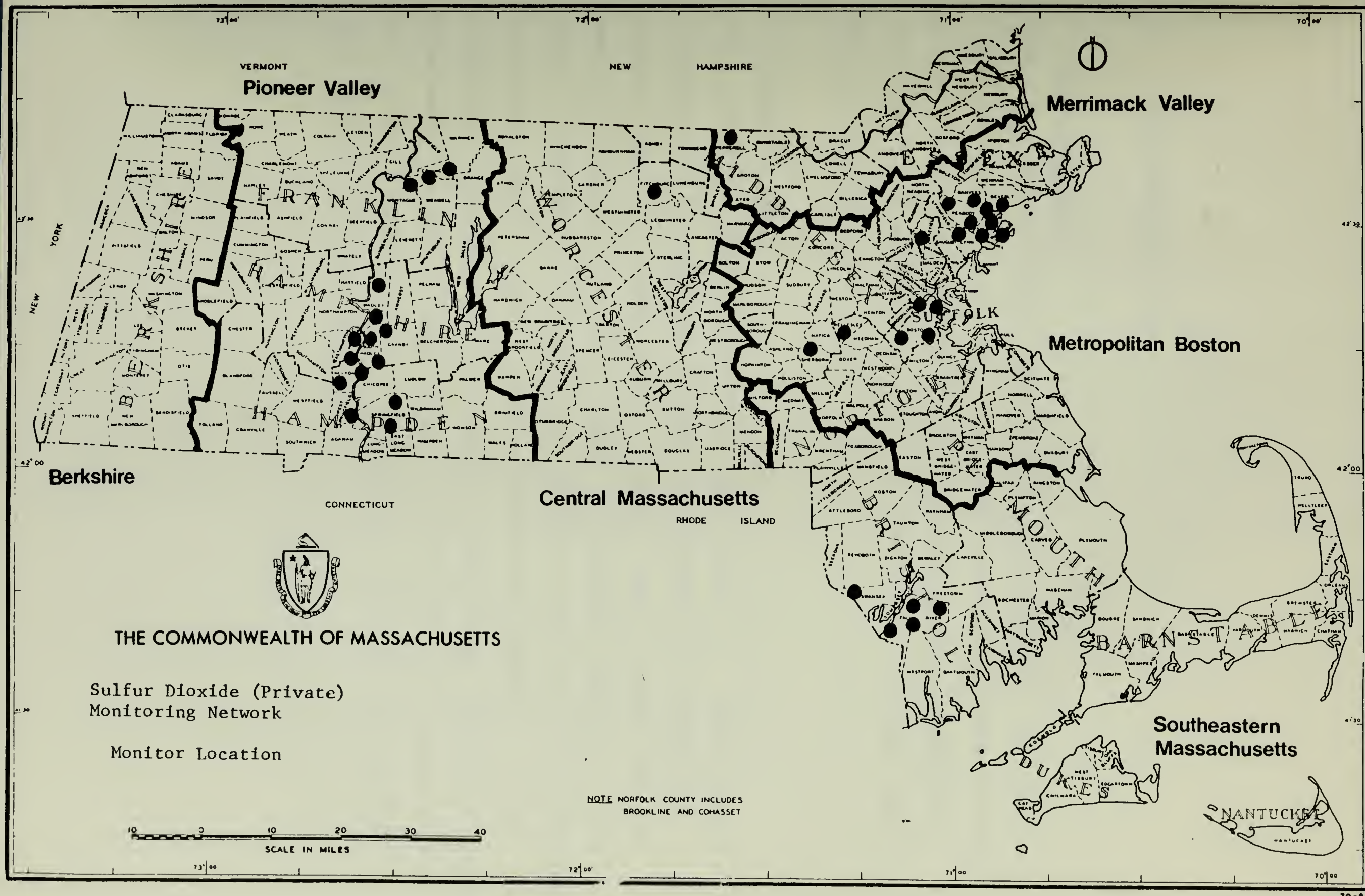
City	Saroad #	Instrument Method	Number of Hourly obs.	Annual Arith. Mean	Daily Maximum 1st 24HR	Daily Maximum 2nd 24hr	Daily Max 3HR obs. Block 1st	Daily Max 1HR obs. Block 2nd	Daily Max 1HR obs.	Daily 2n Ma 1H ob
MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)										
Pepperell	1792-001	20	2164**	*	71	50	113	105	157	10
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)										
Fall River	0580-010	20	8668	25	165	152	417	283	548	50
Fall River	0580-012	20	739**	*	112	96	157	157	220	17
Fall River	0580-013	20	7945	21	238	60	393	367	461	42
Fall River	0580-036	16	8715	21	97	68	317	312	670	41
Swansea	2230-001	16	8694	19	222	102	477	453	673	49

* Annual Arithmetic Mean could not be determined due to insufficient sample size.

** When total observations are less than 6,250, sample size is insufficient to represent sound data results for the year. Sulfur dioxide data are collected throughout the year; 100 percent data capture during this period represents 8,760 hourly observations.

QA - Quality Assurance in Progress.

(6) FIGURE 4 : Private Sampling Network - Sulfur Dioxide 1984



B. CARBON MONOXIDE (CO)

1. Sampling Method

DAQC uses non-dispersive infrared (NDIR) analyzers for CO detection. These analyzers employ a short cell NDIR detection principle coupled with water vapor subtraction. This methodology meets equivalency requirements published by the U.S. Environmental Protection Agency in Part 58, 40 CFR, May 10, 1979.

2. Summary of Data

DAQC operated eight CO monitors in 1984 (Figure 5). There were no violations of the one-hour standard of the National Ambient Air Quality Standards (NAAQS) for CO in 1984. Table 7 shows that the maximum hourly CO value was 32 mg/M^3 at Worcester (2640-020). The Lowell (1080-007) site recorded the highest eight-hour average concen-concentrations (15 mg/M^3). There were five exceedances at Lowell (1080-007), two exceedances at Boston - Essex Street (0240-022), three exceedances at Thomas Street-Worcester (2640-020), and one exceedance at the East Columbus Avenue in Springfield (2160-007) of the eight-hour standard recorded for 1984.

(3) TABLE 7 - PUBLIC SITES

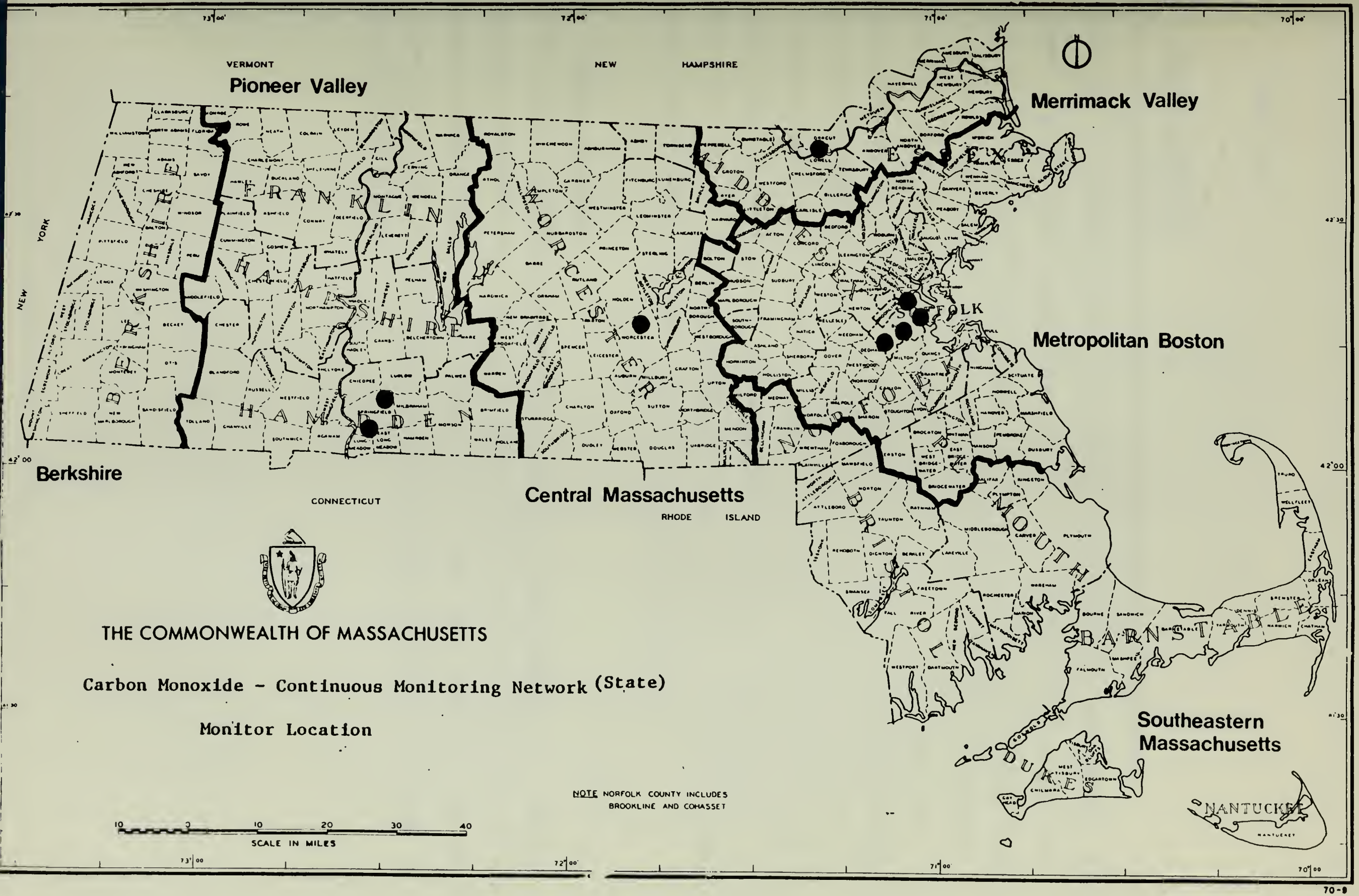
1984 CARBON MONOXIDE MONITORING RESULTS

CO Units: mg/M^3

City	Saroad #	Instrument Method	Number of Hourly obs.	Max. 1 hr. obs.	2nd. Max. 1 hr.	Max. 8 hr. obs.	2nd. Max. 8 hr	# of 8 hr averages above 10
			CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)					
Worcester	2640-020	11	8346	32	23	14	12	3
			MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)					
Lowell	1080-007	11	7731	31	25	15	13	5
			METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)					
Boston	0240-002	11	8396	15	12	10	9	0
Boston	0240-015	11	7940	14	13	7	7	0
Boston	0240-021	11	8415	16	14	8	7	0
Boston	0240-022	11	8401	22	20	13	12	4
			PIONEER VALLEY AIR QUALITY CONTROL REGION (042)					
Springfield	2160-007	11	8524	25	22	13	12	5
Springfield	2160-014	11	8523	16	12	8	7	0

** When total observations are less than 6,570, the sample cannot be guaranteed to contain the actual maximum concentration value for the year. An observation is a single hourly reading at a site. Carbon monoxide data are collected throughout the year; 100 percent data capture during this period represents 8,760 hourly observations.

(4) FIGURE 5: Continuous Air Sampling Monitoring Network - Carbon Monoxide 1984 - Public Sites



THE COMMONWEALTH OF MASSACHUSETTS

Carbon Monoxide - Continuous Monitoring Network (State)

Monitor Location

70-9

C. OZONE (O_3)

1. Sampling Method

The chemilumenescence detection principle and the ultraviolet photometric analyzer method are used in the continuous measurement for ozone. In the chemilumenescence method, the ozone reacts chemically with ethylene gas emitting light. The intensity of the emitted light is proportional to the amount of ambient ozone. In the ultraviolet method, the ultraviolet photometer gauges ozone concentrations by measuring the attenuation of light from ozone in the adsorption cell at a wave length of 254 namometers. The concentration of ozone is directly related to the magnitude of attenuation. This methodology meets equivalency requirements published by the U.S. Environmental Protection Agency in Part 58, 40 CFR, May 10, 1979. The ozone season covers seven months of monitoring from April to October .

2. Summary of Data

DAQC operated fifteen stations for ozone in 1984 (Figure 6). Eleven stations exceeded the .125 parts per million standard, and every Air Quality Control Region (AQCR) recorded at least one exceedance of the standard. Table 8 shows that the maximum ozone value was .209 ppm at Chicopee (0400-008).

(3)TABLE 8 - PUBLIC SITES

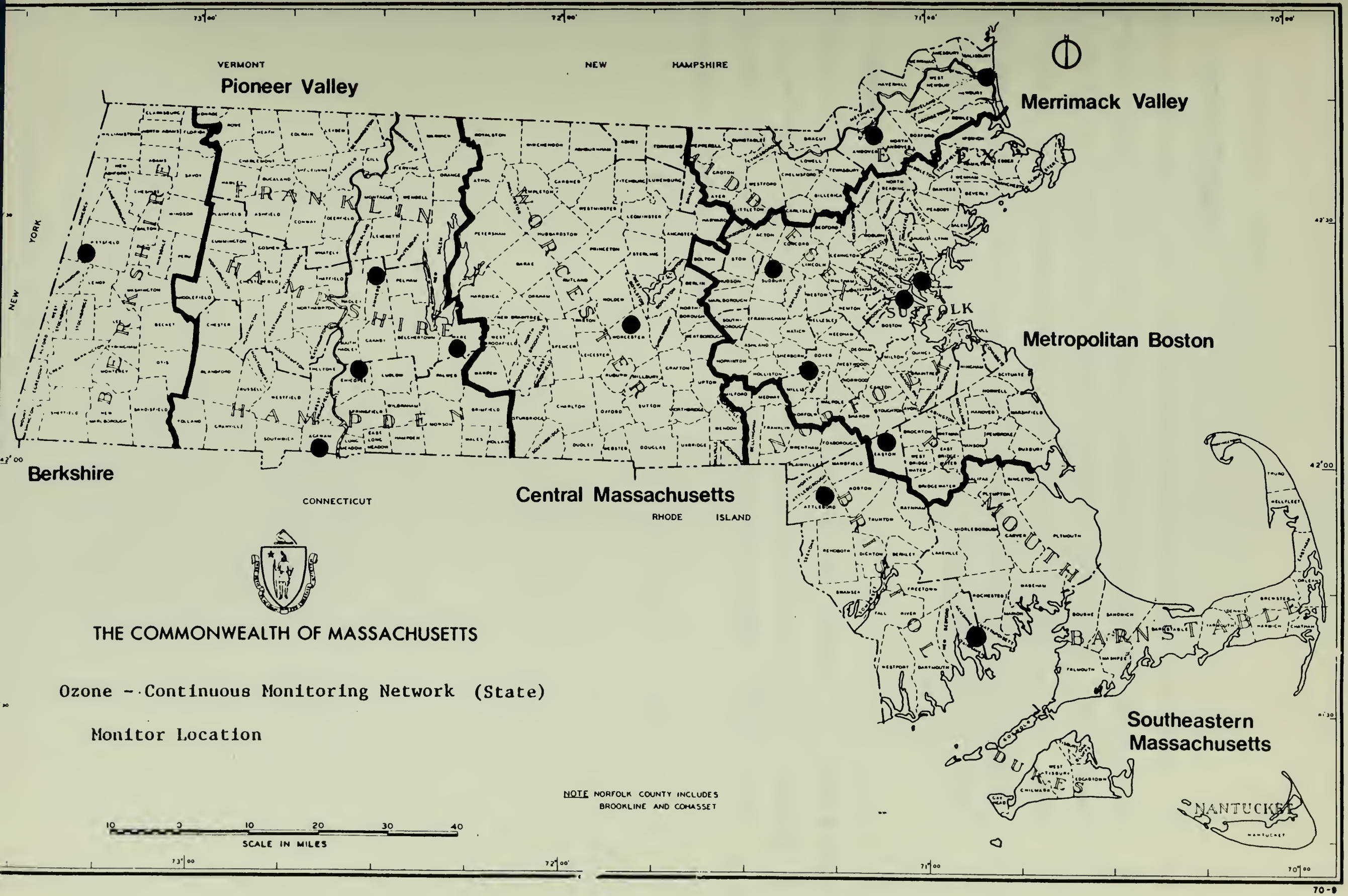
1984 OZONE MONITORING RESULTS

O_3 units = ppm

City	Saroad #	Instrument Method	# of obs.	Max. 1 hr obs.	2nd Max 1 hr obs.	3rd Max 1 hr obs.	Values = > .125 measured for Daily Max
BERKSHIRE AIR POLLUTION CONTROL REGION (117)							
Pittsfield	1800-007	11	3890	.117	.116	.104	0
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)							
Worcester	2640-019	11	4302	.146	.138	.122	2
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)							
Boston	0240-021	11	1054**	.107	.073	.036	0
Chelsea	0380-003	11	6120	.125	.125	.118	2
Easton	0535-001	11	3826**	.151	.133	.128	4
Medfield	1210-001	11	4926	.145	.144	.124	2
Sudbury	2196-001	11	3882	.165	.147	.136	6
MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)							
Lawrence	1000-005	11	4020	.112	.104	.100	0
Newburyport	1520-003	11	3326**	.136	.120	.119	1
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)							
Agawam	0030-003	11	3642**	.144	.141	.139	5
Amherst	0060-002	11	4396**	.125	.125	.122	2
Chicopee	0400-008	11	8194	.209	.168	.133	4
Ware	2360-001	11	3603**	.204	.150	.135	6
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)							
Attleboro	0120-004	11	3306**	.141	.141	.130	4
Fairhaven	0570-002	11	4018	.206	.185	.161	9

** When total observations are less than 3,852, the sample cannot be guaranteed to contain the actual maximum concentration value for the year. An observation is a single hourly reading at a site; 100 percent data capture during the 4/1 to 10/31 ozone season represents 5,136 observations at each monitor.

(4) FIGURE 6: Continuous Air Sampling Network - Ozone 1984 - Public Sites



THE COMMONWEALTH OF MASSACHUSETTS

Ozone -- Continuous Monitoring Network (State)

Monitor Location

NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET

10 0 10 20 30 40

SCALE IN MILES

70-8

D. NITROGEN DIOXIDE (NO_2)

1. Sampling Method

NO_2 is measured by the chemilumenescence detection principle. In this method, nitric oxide (NO) and oxides of nitrogen (NO_x) react with ozone and the resultant chemical products emit light. The intensity of this light is proportional to the concentrations of NO_2. This methodology meets equivalency requirements published by the U.S. Environmental Protection Agency in Part 58, 40 CFR, May 10, 1979.

2. Summary of Data

DAQC operated ten NO_2 monitoring sites in 1984 (Figure 7). There were no recorded violations of the National Ambient Air Quality Standard (NAAQS) for NO_2. Table 9 shows that the highest NO_2 levels were recorded in Boston (0240-002).

(3) TABLE 9 - PUBLIC SITES

1984 NITROGEN DIOXIDE MONITORING RESULTS

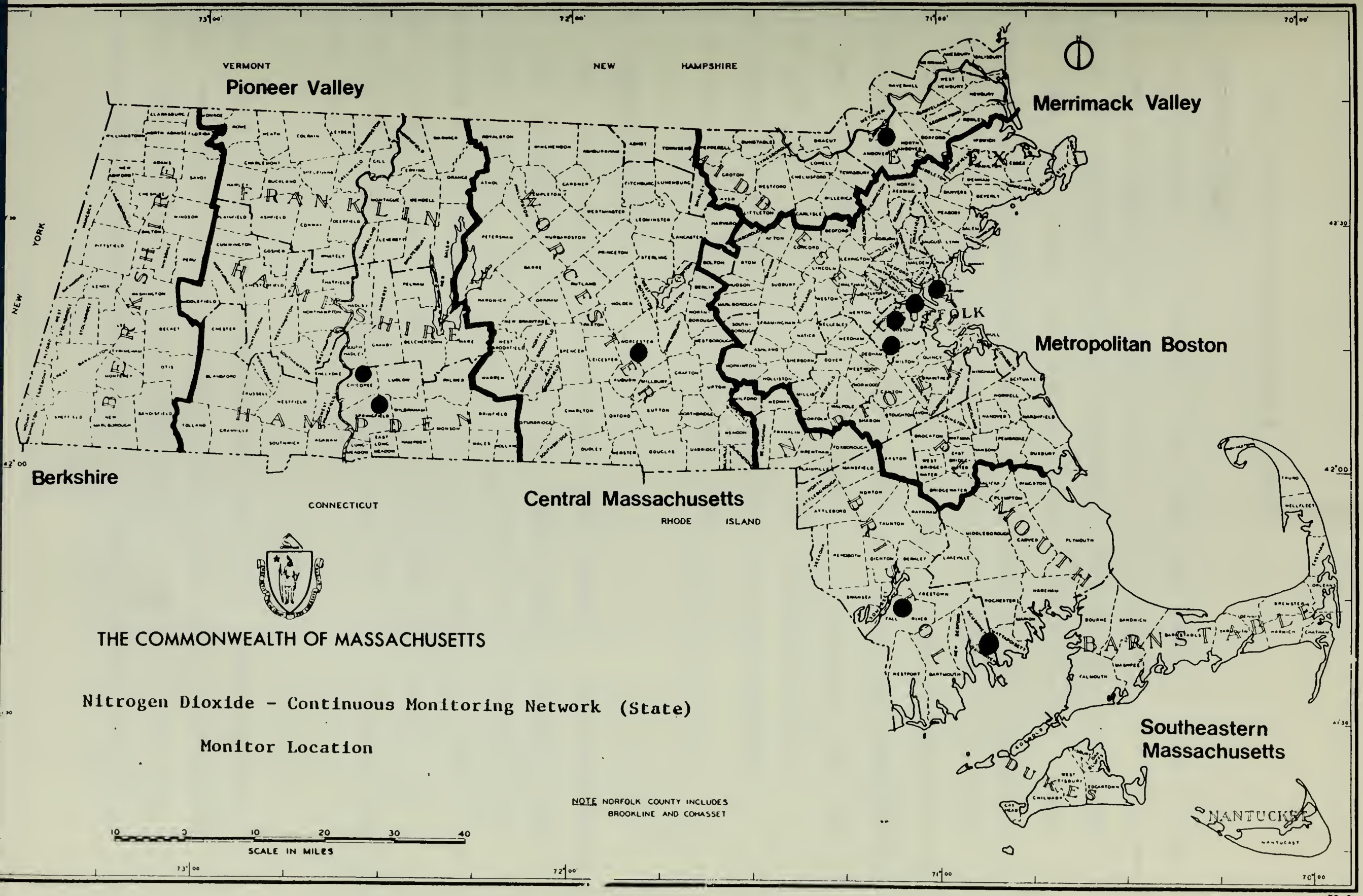
NO_2 units: ug/m^3

City	Saroad #	Instrument Method	Number of Hourly obs.	Max 1 hr obs.	2nd Max 1 hour obs.	Annual Arithmetic Mean
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)						
Worcester	2640-019	14	3317**	188	169	*
MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)						
Lawrence	1000-005	14	7822	263	263	41
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)						
Boston	0240-002	14	7838	417	384	83
Boston	0240-021	14	7893	333	263	61
Boston	0240-026	14	414**	132	113	*
Chelsea	0380-003	14	6926	667	517	42
PIONEER VALLEY AIR POLLUTION CONTROL REGION (042)						
Chicopee	0400-008	14	3846**	226	207	*
Springfield	2160-015	14	6895	470	385	47
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)						
Fairhaven	0570-002	14	127**	64	64	*
Fall River	0580-004	14	7857	169	160	28

* Annual Arithmetic Mean could not be determined due to insufficient sample size.

** When total observations are less than 6,570, the sample cannot be guaranteed to contain the actual maximum concentration value for the year. Nitrogen dioxide data are collected throughout the year; 100 percent data capture during this period represents 8,760 hourly observations.

(4) FIGURE 7: Continuous Air Sampling Network - Nitrogen Dioxide - 1984 Public Sites



THE COMMONWEALTH OF MASSACHUSETTS

Nitrogen Dioxide - Continuous Monitoring Network (State)

Monitor Location

NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET

10 0 10 20 30 40
SCALE IN MILES

70-9

E. TOTAL SUSPENDED PARTICULATES (TSP)

1. Sampling Method

TSP measurements are routinely taken using the standard high volume air sampler method every sixth day. In this procedure, air is drawn through a pre-weighed 8"x10" fiberglass filter at the rate between 40 to 60 CFM for a period of 24 hours beginning at midnight. At the conclusion of the sampling, the filter is removed and transported to a laboratory for reweighing. The difference in weight in milligrams is divided by the volume of air passed through, giving a weight per unit volume result, i.e., ug/m^3. Upon completion of the TSP (weight/unit volume) calculation, several other physical and chemical tests can be performed upon the collected sample. This methodology meets equivalency requirements published by the U.S. Environmental Protection Agency in Part 58, 40 CFR, May 10, 1979.

2. Summary of Data

In 1984, there were 25 state-operated TSP monitors , the same amount in 1983 (Figure 8). Twenty one sites had at least 75 percent data capture for 1984. There were no violations of the Annual Primary Standard of the National Ambient Air Quality Standards (NAAQS) for TSP in 1984. Table 10 shows that the highest Annual G-Mean (58 ug/M^3)occurred at the Columbus Street Fire Station in Boston Back Bay (0240-024).

There were 28 privately operated TSP monitors in 1984 (Figure 9). There were no violations of the primary annual NAAQS. Twenty-one sites had at least 75 percent data capture. Table 11 shows that the highest annual G-Mean (56ug/M^3) was recorded at Boston (0240-018).

(3) TABLE 10 - PUBLIC SITES

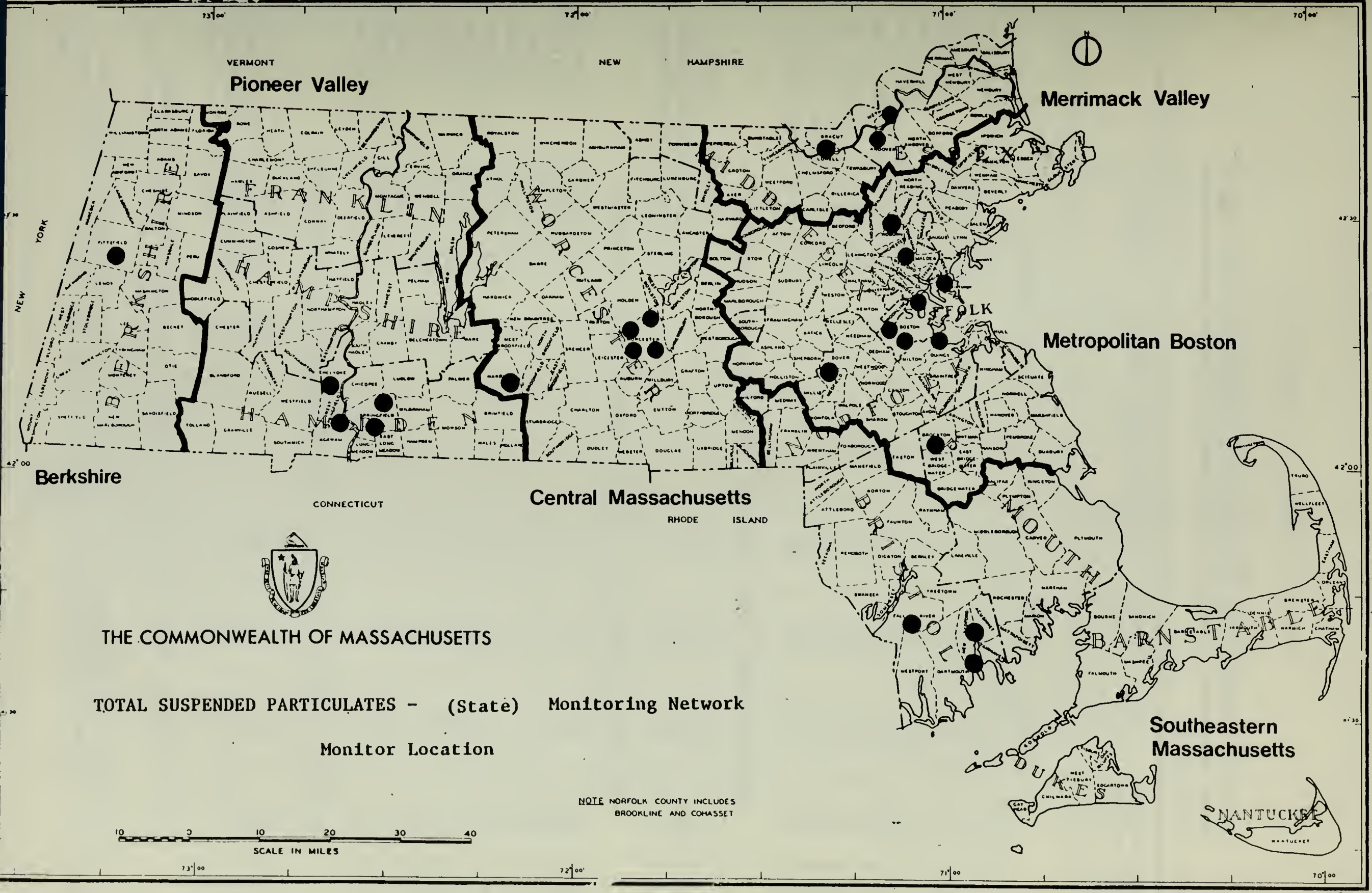
1984 TOTAL SUSPENDED PARTICULATES MONITORING RESULTS

TSP Units: ug/M^3

City	Saroad #	Number of Obs.	Minimum Obs.	1st Max Obs.	2nd Max Obs.	3rd Max Obs	Annual Arith. Mean	Annual Geo. Mean
BERKSHIRE AIR QUALITY CONTROL REGION (117)								
Pittsfield	1800-006	51	14	155	115	97	51	45
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)								
Warren	2372-001	36**	8	85	63	55	*	*
Worcester	2640-013	54	12	88	79	76	41	37
Worcester	2640-016	54	22	173	147	121	61	55
Worcester	2640-018	1**	38	38	*	*	*	*
Worcester	2640-021	43	18	95	73	71	45	41
MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)								
Lawrence	1000-003	38**	16	99	60	58	*	*
Lawrence	1000-005	58	9	135	96	94	43	39
Lowell	1080-006	54	14	106	89	80	44	41
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)								
Boston	0240-012	55	20	134	132	89	59	56
Boston	0240-021	59	18	130	99	96	56	53
Boston	0240-024	47	26	178	123	92	62	58
Brockton	0320-003	55	11	78	70	65	36	34
Chelsea	0380-002	57	20	125	118	111	59	54
Medfield	1210-001	54	10	97	75	51	31	29
Medford	1220-002	56	13	109	91	78	48	44
Quincy	1880-007	54	18	103	75	75	44	41
Woburn	2620-002	49	12	90	90	80	41	38
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)								
Holyoke	0860-007	57	18	134	96	74	51	48
Springfield	2160-011	129	17	181	126	121	54	49
Springfield	2160-015	59	18	110	106	88	48	46
W.Springfld	2475-003	58	17	130	110	94	49	45
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)								
Fall River	0580-001	47	18	104	72	69	43	41
New Bedford	1500-003	8**	29	55	40	39	*	*
New Bedford	1500-004	43	20	91	73	72	40	38

* Annual Arithmetic Mean and Annual Geometric Mean could not be determined due to insufficient sample size.
** When total observations are less than 40, the sample cannot be guaranteed to contain the actual maximum concentration value for the year.

(4) FIGURE 8 : Air Sampling Network Total Suspended Particulates - 1984 Public Sites



THE COMMONWEALTH OF MASSACHUSETTS

TOTAL SUSPENDED PARTICULATES - (State) Monitoring Network

Monitor Location

NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET

70-9

(5) TABLE 11 - PRIVATE SITES

1984 TOTAL SUSPENDED PARTICULATES MONITORING RESULTS

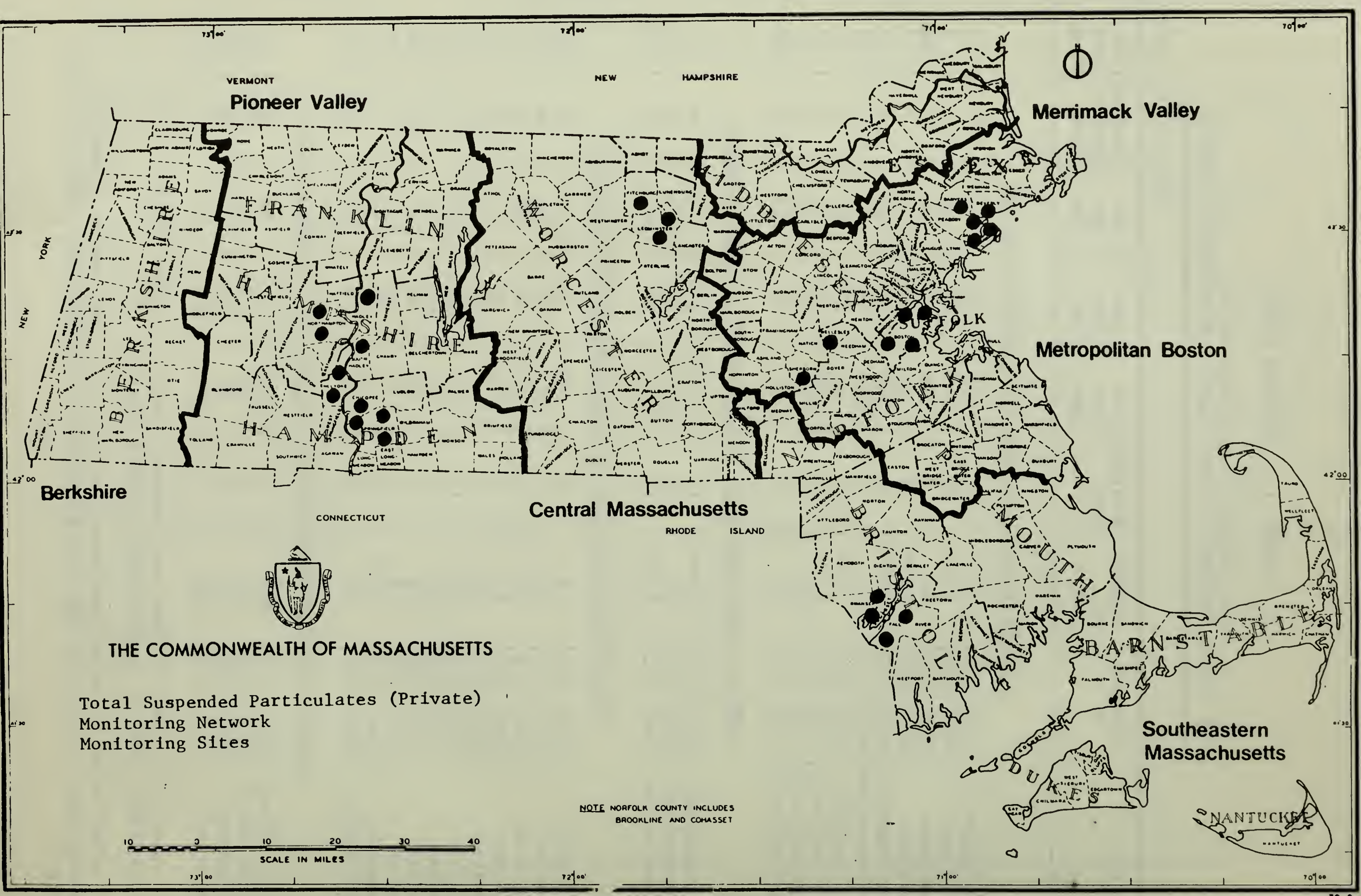
TSP Units: ug/M^3

City	Saroad #	Number of Obs.	Minimum Obs.	1st Max Obs.	2nd Max Obs.	3rd Max Obs	Annual Arith. Mean	Annual Geo. Mean
PIONEER VALLEY AIR QUALITY CONTROL REGION								
Chicopee	0400-006	61	11	166	133	114	54	45
Hadley	0789-002	14**	10	*	47	28	*	*
Holyoke	0860-005	64	8	74	70	64	31	28
Holyoke	0860-009	14**	12	60	44	41	*	*
Northampton	1600-002	4**	14	66	33	33	*	*
Northampton	1600-003	61	4	149	90	75	38	33
S. Hadley	2126-002	4**	16	46	29	20	*	*
Springfield	2160-009	60	10	130	89	78	42	37
Springfield	2160-012	53	9	138	90	82	47	41
Springfield	2160-013	59	10	98	94	93	44	39
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION								
Fitchburg	0620-010	29**	14	97	96	95	*	*
Leominster	1040-001	41	18	127	112	98	56	52
Leominster	1040-002	21**	12	77	69	61	*	*
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION								
Beverly	0220-002	113	6	79	72	69	29	26
Boston	0240-018	56	1	177	139	104	64	56
Boston	0240-019	59	1	50	49	47	28	25
Boston	0240-020	61	1	95	82	71	38	34
Boston	0240-021	59	1	107	97	76	46	40
Danvers	0480-003	55	13	179	107	99	55	49
Salem	1980-004	338	7	104	101	92	31	27
Salem	1980-005	344	6	128	84	80	30	26
Salem	1980-006	353	9	175	146	134	44	39
Sherbon	2042-001	14**	1	36	33	30	*	*
Wellesley	2420-001	59	5	75	74	64	30	27
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CENTRAL REGION								
Fall River	0580-013	353	1	100	95	94	30	24
Fall River	0580-036	324	3	109	107	95	29	25
Somerset	2080-002	92	9	87	83	81	38	35
Swansea	2230-001	336	2	217	122	119	30	25

* Annual Arithmetic Mean and Annual Geometric Mean could not be determined due to insufficient sample size.

** When total observations are less than 40, the sample cannot be guaranteed to contain the actual maximum concentration value for the year.

(6) FIGURE 9: Air Sampling Network - Total Suspended Particulates - 1984 Private Sites



F. LEAD (Pb)

1. Sampling Method

Lead measurements are routinely taken using the standard high volume air sampler method every sixth day. In this procedure, air is drawn through a pre-weighed 8"x10" fiberglass filter at the rate between 40 to 60 CFM for a period of 24 hours beginning at midnight. At the conclusion of the sampling, the filter is removed and transported to a laboratory for reweighing. This analysis continues with the filter cut and placed in a nitric acid bath. The solution is then passed through an atomic absorption analyzer. This methodology meets equivalency requirements published by the U.S. Environmental Protection Agency in Part 58, 40 CFR, May 10, 1979.

2. Summary of Data

In 1984, there were six state-operated lead monitors (Figure 10). There were no recorded exceedances of the three-month National Ambient Air Quality Standards (NAAQS) for lead in 1984. Table 12 and Figure 10 show that the maximum quarterly level occurred in Springfield (2160-007) with an A-mean of .68 ug/M^3.

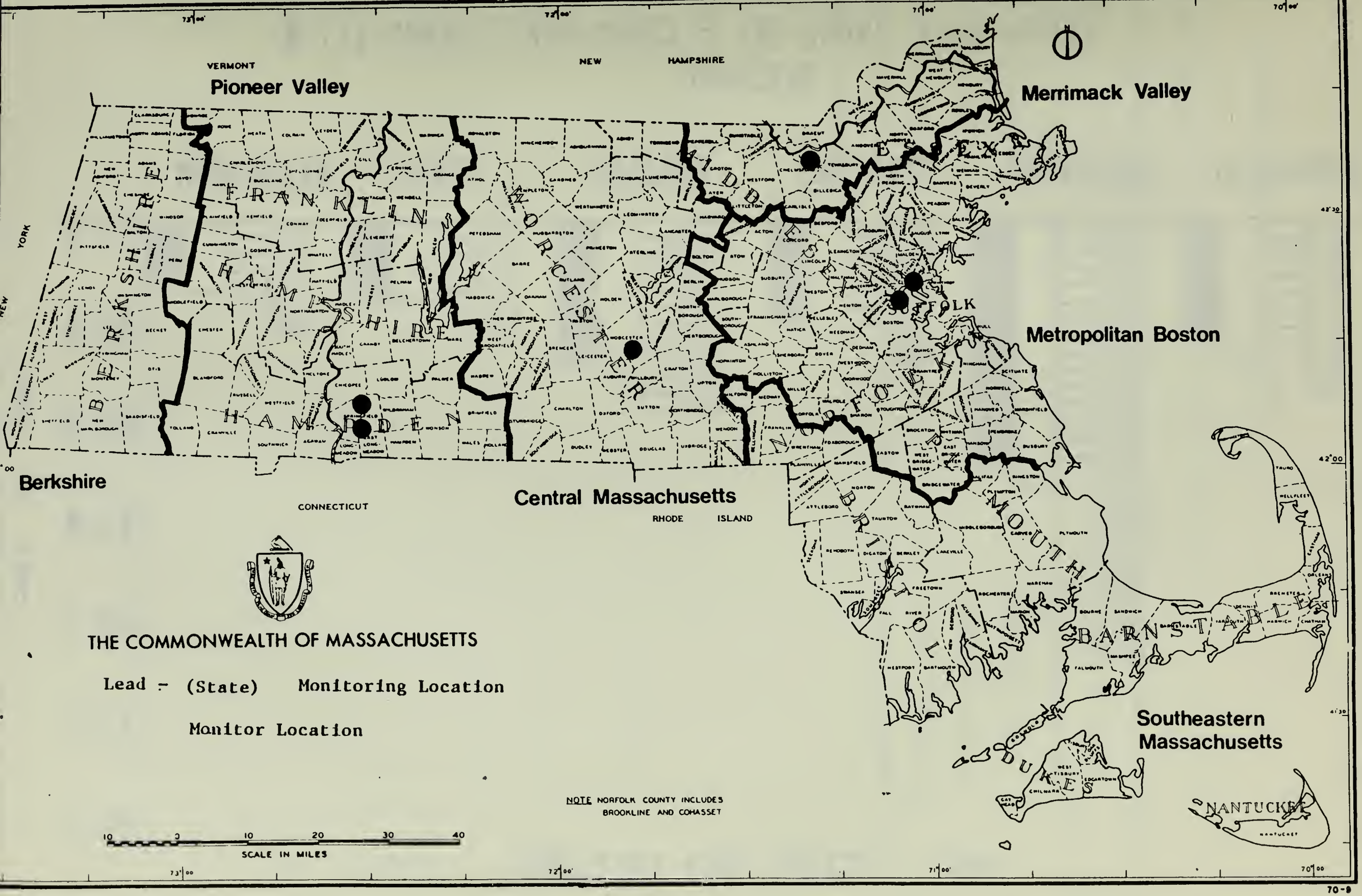
(3)TABLE 12 - PUBLIC SITES

1984 LEAD MONITORING RESULTS

Pb units: ug/M^3

City	# Saroad	Method Instrument	Obs. No.of	Max Obs. 1st	Max Obs. 2nd	Arithmetic Mean Quarter 1st	2nd	3rd	4th
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)									
Worcester	2640-016	92	53	.64	.43	.16	.18	.21	.28
MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)									
Lowell	1080-006	92	54	1.30	.50	.20	.20	.22	.28
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)									
Boston	0240-002	92	49	1.00	.89	.38	.40	.48	.48
Chelsea	0380-002	92	57	.95	.58	.27	.26	.27	.34
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)									
Springfield	2160-007	92	60	3.30	1.80	.64	.68	.60	1.10
Springfield	2160-011	92	61	1.00	.88	.31	.35	.32	.47

(4) FIGURE 10: Air Sampling Network - Lead - 1984 - Public Sites



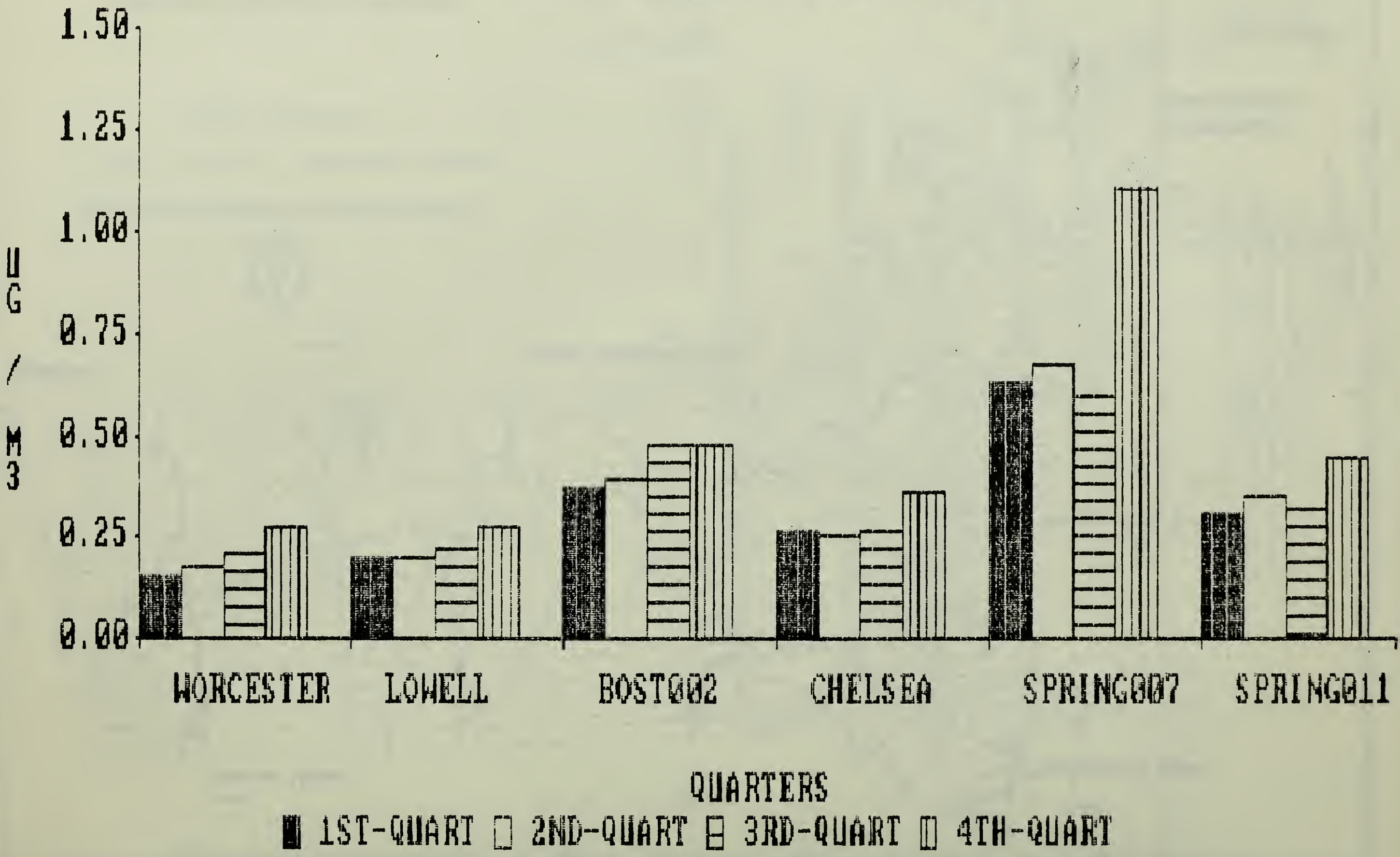
THE COMMONWEALTH OF MASSACHUSETTS

Lead - (State) Monitoring Location

Monitor Location

(5) FIGURE 11

QUARTERLY LEAD LEVELS - 1984



G. POLLUTANT STANDARD INDEX (PSI)

1. Definition

The Pollutant Standard Index provides a simple, uniform way to report concentrations of ozone -- the predominant form of photochemical oxidants or smog. Through its statewide ozone monitoring network, DAQC evaluates the previous day's ozone level and predicts the following day's ozone concentration based on the analysis and on weather forecasts. DAQC reports ozone PSI values daily during the months of April through October for three areas: Eastern, Central, and Western Massachusetts.

(2) **TABLE 13 PSI Index and General Health Effects**

Index Value PSI Descriptor *	General Health Effects	Cautionary Statements
500		
hazardous	Premature death of ill and elderly. Healthy people will experience adverse symptoms that affect their normal activity.	All persons should remain indoors, keeping windows and doors closed. All persons should minimize physical exertion and avoid traffic.
400		
hazardous	Premature onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in healthy persons.	Elderly and persons with existing respiratory diseases should stay indoors and avoid physical exertion. General population should avoid physical activity.
300		
very unhealthful	Significant aggravation of symptoms and decreased exercised tolerance in persons with heart or lung disease with widespread symptoms in the healthy population.	Elderly and persons with existing heart or lung disease should stay indoors and avoid physical activity.
200		
unhealthful	Mild aggravation of symptoms in susceptible persons, with irritation symptoms in the healthy population.	Persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity.
100		
moderate		
50		
good		
0		

* American Lung Association

(3) TABLE 14 PSI for 1984 by Region

This table represents the number of days during the ozone season (April-October) that fell into the good, moderate, and unhealthful categories on a regional level statewide. In 1984, there were no days that fell in the very unhealthful category.

		EASTERN	CENTRAL	WESTERN
APRIL	Good	20	28	14
	Moderate	10	2	16
	Unhealthful	0	0	0
MAY	Good	16	28	10
	Moderate	15	3	21
	Unhealthful	0	0	0
JUNE	Good	13	21	17
	Moderate	16	9	11
	Unhealthful	1	0	2
JULY	Good	10	17	16
	Moderate	19	13	11
	Unhealthful	2	1	4
AUGUST	Good	5	16	9
	Moderate	22	14	20
	Unhealthful	4	1	2
SEPTEMBER	Good	15	15	21
	Moderate	14	14	9
	Unhealthful	1	1	0
TOTAL	Good	79	125	87
	Moderate	96	55	88
	Unhealthful	8	3	8

H. SULFATES - PRIVATE SITES

1. Sampling Method

Sulfate measurements are taken at private monitoring sites using the standard high volume air sampler. In this procedure, air is drawn through a fiberglass filter. The filter is placed in a 140 ml. beaker and 40 ml. distilled, deionized water is added. This is covered for 30 minutes and is poured through a Whatman #42 filter into a 200 ml. volumetric flask. Approximately 40 ml. hot distilled, deionized water is added to a beaker which is covered and left to sonicate for 10 minutes in an ultrasonic bath. The beaker and filter pieces are rinsed two or three times, each time pouring through filter into flask. At the conclusion of the sampling, the filter is removed and transported to the laboratory for analysis. The analysis involves turbidimetry using a Hach turbidimeter and sulfaver reagent.

2. Summary of Data

There were 10 privately-operated sulfate monitors in 1984 (Figure 12). Nine sites had at least 75 percent data capture. Table 15 shows that the highest levels were recorded at Chicopee (0400-006).

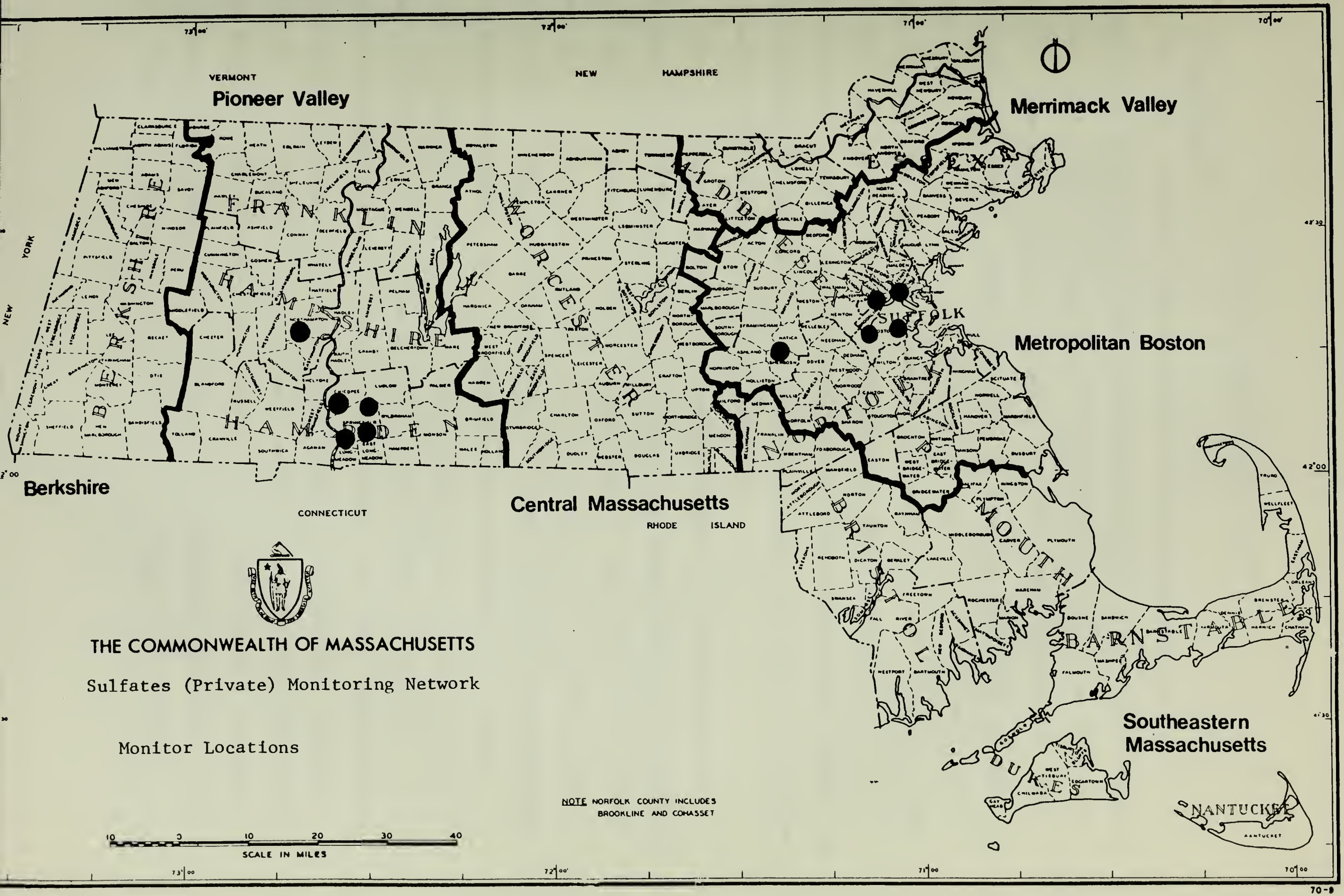
(3) TABLE 15 - PRIVATE SITES

1984 SULFATES MONITORING RESULTS

SO_4 Units: ug/M^3

City	Saroad #	Number of Obs.	Minimum Obs.	1st Max Obs.	2nd Max Obs.	3rd Max Obs	Annual Arith. Mean
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)							
Chicopee	0400-006	61	3	32	24	22	10
Northampton	1600-003	61	3	23	21	20	9
Springfield	2160-009	60	4	24	23	21	10
Springfield	2160-012	54	3	25	23	22	10
Springfield	2160-013	59	3	25	23	23	9
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)							
Boston	0240-018	55	5	24	22	22	11
Boston	0240-019	59	4	21	20	19	10
Boston	0240-020	61	2	21	21	21	10
Boston	0240-021	59	5	23	22	19	10
Sherbon	2042-001	14*	0	13	11	10	6

(4) FIGURE 12: Air Sampling Network Sulfates 1984 - Private Sites



THE COMMONWEALTH OF MASSACHUSETTS

Sulfates (Private) Monitoring Network

Monitor Locations

1984 ACID PRECIPITATION REPORT

1. Monitoring

The acidity of precipitation falling on Massachusetts is considerably more acidic than precipitation falling in remote regions of the world, where precipitation pH generally ranges from pH 5.0 to pH 5.6. Damage to aquatic resources by acid precipitation has been documented in Sweden, Norway, and the Adirondack Mountains of New York. Acid precipitation has also been implicated as one of several possible factors involved in forest declines seen in Germany and New England. For these reasons the Massachusetts Department of Environmental Quality Engineering monitors the quantity and acidity of precipitation at several locations in the state in order to determine the volume and acidity of precipitation.

The acid precipitation monitoring network in Massachusetts is composed of four event monitoring sites and three National Atmospheric Deposition Program (NADP) monitoring sites. Event monitoring sites recorded the pH and the volume of precipitation on a precipitation event basis. Data from these sites are used for daily recorded acid precipitation reports and in analyses such as presented in this report. Event monitoring sites are located at the University of Massachusetts, Amherst; the College of Holy Cross, Worcester; Carver/Bionomics, Carver; and in Swampscott. The NADP sites collect precipitation on a weekly basis from Tuesday to Tuesday. Chemical analyses includes major cations and anions, pH, specific conductance, and precipitation volume. All NADP chemical analyses are conducted by the NADP Central Analytical Laboratory in Champagne, Illinois. The NADP sites are located at Quabbin Reservoir; the Waltham State

Agricultural Experiment Station (SAES); and the National Park Service at the Cape Cod National Seashore in Truro. The locations of event monitoring sites and NADP monitoring sites are depicted in Figure 13.

2. Precipitation Acidity

The pH of precipitation varies widely at each monitoring site over the course of a year from highly acidic events (pH $\leq$3.6) to slightly acidic events (pH >4.7). Of the 272 events recorded at the four event sites, 33 percent (90 events) had a pH $\leq$4.0 (see Figure 14), 53.3 percent (145 events) had 4.0 >pH $\leq$4.7, and 13.6 percent (37 events) had pH >4.7.

During 1984 pH at the event sites ranged as follows:

U. Mass.	pH 3.37 - 5.62
Holy Cross	pH 3.54 - 5.10
Swampscott	pH 3.50 - 5.84
Carver	pH 3.60 - 5.30

Converted to hydrogen ion concentrations these represent ranges of:

U. Mass.	426 - 2.4 ueq/l
Holy Cross	288 - 7.9 ueq/l
Swampscott	316 - 1.4 ueq/l
Carver	251 - 5.0 ueq/l

Figures 14 and 15 present the pH of individual events at the event monitoring sites. The monthly volume-weighted pH (from Table 16) is included on each graph. The lowest pH event at each site occurred during June. The highest pH event occurred during February at the University of Massachusetts, during March at Holy Cross and Swampscott, and during November at Carver. The lowest monthly volume-weighted pHs occurred during September at the University of Massachusetts, Holy Cross, and Carver, and during August at

Swampscott. In all cases except Carver, the lowest volume-weighted pHs coincided with the lowest precipitation totals. The highest monthly volume-weighted pH occurred during November at the University of Massachusetts, Holy Cross, and Carver while it occurred during February at Swampscott with the second highest in November. There was no correlation between the highest volume-weighted pH and precipitation totals. Figures 17 and 18 present pH converted to hydrogen ion concentrations. The highest hydrogen ion concentrations (lowest pH events) occurred during June at each site.

The relationship between the size of a precipitation event and precipitation pH can be seen in Figure 19. For each event at the four event monitoring sites, the hydrogen ion concentration has been plotted against precipitation volume. The most acidic (pH <3.7) events are small events (<0.25 inches). Most large precipitation events (>1 inch) have a hydrogen ion concentration <50 ueq/l (pH>4.30).

Table 16 also presents the annual volume-weighted pH at the event sites. The University of Massachusetts site had the highest annual pH, while Swampscott had the lowest. Swampscott had the highest precipitation total, not unexpected for a coastal site, and the lowest annual pH. Carver, with the second lowest annual pH, recorded between 8.61 and 19.65 inches less precipitation than the University of Massachusetts, Holy Cross, and Swampscott sites.

Table 17 and Figure 20 present the monthly volume-weighted pHs for the NADP sites. The pHs were similar during most months with Truro generally displaying the highest weighted pH and Quabbin Reservoir the lowest. However, the pHs at Quabbin Resevoir from March - June do not conform well to the pattern seen for Waltham and Truro.

The March pH was low due to a power failure resulting in failure to capture all precipitation events. The April and May values are too high and the June value too low due to differing sampling periods at Quabbin Reservoir. As a result significant amounts of precipitation were included with April or May data which at Waltham and Truro was included with March or June data. The annual weighted pH was lowest at the Quabbin Reservior site and highest at Truro. This pattern is in direct contrast to that seen for the event monitoring sites where the University of Massachusetts site had the highest annual pH and Swampscott, and Carver the lowest. In part this discrepancy can be accounted for because the March weighted pH at the Quabbin Reservoir site was artificially low. With March excluded from analysis the annual weighted pH for the Quabbin Reservoir site was 4.38 and for the University of Massachusetts was 4.41. These figures compare more favorably. The lowest monthly weighted pH at NADP sites occurred during August at Truro and Waltham and during September at Quabbin Reservoir (excluding March), a pattern similar to that of the event sites. However, only at Truro did the lowest weighted pH coincide with the lowest precipitation total. The highest weighted pH occurred during November at Waltham and Quabbin Reservoir and during March at Truro. The highest weighted pH coincided with the largest precipitation totals only at Truro. Precipitation totals for the three sites were similar with the largest volume falling at Truro. (See Table 17).

Variability in the pH of single events at different monitoring sites reflects the influence of a variety of factors such as the direction of the storm track, local sources of pollutants, quantity of precipitation, and local meteorology. One such influence is that of

the ocean on coastal sites. During the storm of April 24, 1984 this influence could be seen in the following data from event sites:

	pH	ppt. (inches)
U. Mass.	4.38	0.47
Holy Cross	4.65	0.66
Swampscott	4.95	1.60
Carver	5.00	1.00

This storm was characterized by a low pressure system centered off the southern coast of New England. Coastal sites received more rain and pHs were highest near the coast and lowest at the Quabbin Reservoir site. Gradients from the coast to inland sites may also be seen from NADP data for this period:

			Deposition (mg/m^2)			
	pH	ppt.	Cl^-	SO_4^{--}	NO_3^-	$SO_4^{--}+NO_3^-$
Quabbin Res.	4.32	0.52	1.94	31.94	29.31	61.25
Waltham	4.71	1.36	8.74	43.34	12.58	55.92
Truro	5.21	1.20	27.89	20.77	9.39	30.16

The sum of sulfate and nitrate deposition was highest at the Quabbin Reservoir, the site furthest inland, and lowest at the Truro site, while deposition of chloride, primarily derived from seaspray, was lowest at the Quabbin Reservoir site.

Tables 18 and 19 present annual volume-weighted pHs and precipitation quantities for event and NADP sites from 1982-1984. The annual weighted pH for the Truro NADP site and the University of

Massachusetts and Holy Cross event sites has increased slightly or remained level from 1982-1984. The annual pH at the Quabbin Reservoir and Waltham NADP sites, and the Swampscott event site was highest in 1983. Caution should be exercised, however, in making comparisons between years where data is missing from one year.

3. Deposition of Cations and Anions

Deposition of cations and anions is influenced by numerous factors such as the volume of precipitation, and by contributions of cations and anions from seaspray, agriculture, and anthropogenic sources. The acidity of precipitation is determined by the total ion balance, which includes sulfate, nitrate, and hydrogen ion concentrations and the basic cations calcium, magnesium, potassium, and ammonium. Table 20 presents the annual volume-weighted concentrations of individual cations and anions at the NADP sites. Cations and anions which are contributed by seaspray to precipitation (Ca^{++}, Mg^{++}, K^{+}, Na^{+}, Cl^{-}) are in greatest concentrations at Truro. Nitrate, sulfate (a portion of which is contributed by seaspray), ammonium and hydrogen ion concentrations are highest at the Quabbin Reservoir.

Figure 21 presents the monthly volume-weighted concentrations of sulfate for the three NADP sites. The high sulfate concentration for the Quabbin Reservoir site for March may be artificially high as a result of collector failure and in June due to a different collection period than Waltham and Truro.

Table 21 presents the monthly and annual volume-weighted concentrations of sulfate with the seaspray contribution removed. (excess SO_4= [Tot. SO_4^{--}] - .12[Na^{+}] if [Cl^{-}]/[Na^{+}] >1.16 or [Tot. SO_4^{--}] - .103[Cl^{-}] if [Cl^{-}]/[Na^{+}] <1.16). The largest contributions of sulfate to precipitation via seaspray occurred at Truro, a coastal

site. Of the annual weighted average at Truro, 39.1 percent of the sulfate was contributed by seaspray as determined above, as compared to 4.1 percent at Waltham and 2.1 percent at the Quabbin Reservoir. Contributions of sulfate to precipitation are generally higher during the winter months and lower during the summer months, as seen from the percent sulfate contributed by seaspray in Table 21. Coastal storms play a more important role during the winter months than during the summer months when storms originate predominantly from the west or southwest. Figure 21 presents the corrected concentrations for sulfate with the seaspray contribution removed. The months showing the greatest change in sulfate concentrations at Truro are January through April and November and December relative to the other NADP sites. These months represent the time period with the greatest occurrence of ocean storms, at which time contributions from seaspray to deposition would be greatest.

Figure 23 presents the monthly volume-weighted concentrations of nitrate for the NADP sites. Nitrate is not greatly affected by contributions from seaspray, therefore no corrections have been applied. Nitrate concentrations recorded at Waltham and Truro are very similar and generally lower than for the Quabbin Reservoir site. Again, March and June values for Quabbin Reservoir may be artificially high and April and May values artificially low, as previously discussed.

Table 22 presents the average monthly deposition (mg/m^2) of cations and anions at the three NADP sites. Deposition of the cations and anions contributed by seaspray to precipitation are greatest at the Truro site and lowest at the Quabbin Reservoir site. Deposition of ammonium and nitrate are greatest at the Quabbin Reservoir site.

Note that while the highest corrected sulfate concentration (Table 20) occurred at Quabbin Reservoir, Waltham and Truro had higher 'uncorrected' average depositions of sulfate. Table 23 presents the total annual wet deposition of cations and anions. The pattern seen in Table 22 is repeated here.

Comparisons of the total annual wet deposition of sulfate and nitrate with annual totals from 1982 and 1983 in Table 24 reveals that wet deposition of sulfate has decreased slightly at Quabbin Reservoir, but was highest during 1983 at Waltham and Truro. Nitrate deposition has increased slightly at Quabbin Reservoir and Waltham while it has decreased since 1983 at Truro. These figures may in part be influenced by the total annual precipitation volume. Years with lower total precipitation volumes will generally show lower wet deposition figures. These figures do not account for dry deposition which may increase total deposition to as much as twice these levels and which may be relatively greater during dry years than in wet years.

FIGURE 13: Location of precipitation monitoring sites in Massachusetts.

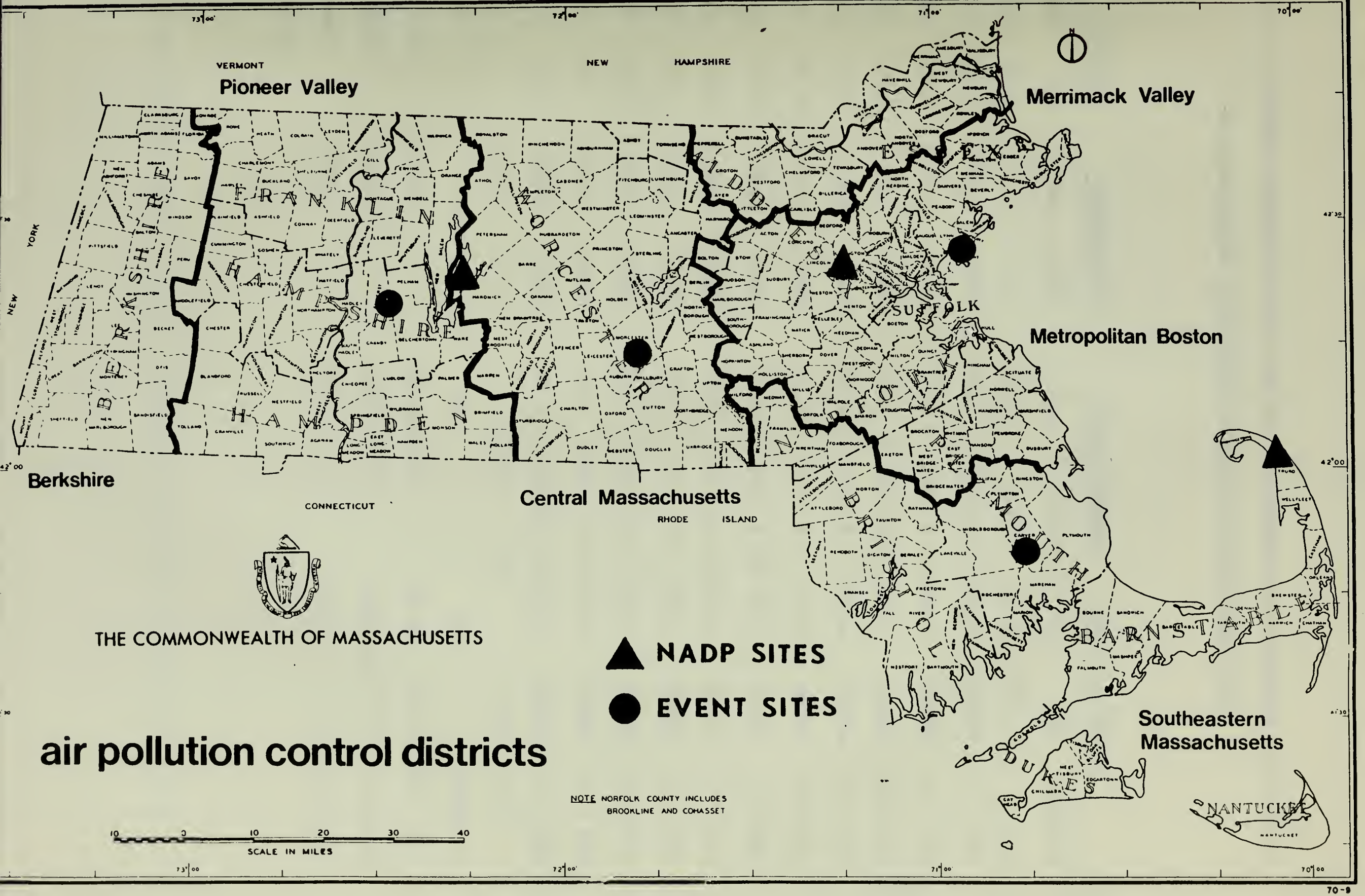


TABLE 16. Annual Volume-Weighted pH and Precipitation (Inches) for Four Massachusetts Event Monitoring Sites.

	UNIV. MASS.		HOLY CROSS		SWAMPSCOTT		CARVER	
MONTH	PPT	pH	PPT	pH	PPT	pH	PPT	pH
JAN	1.75	4.24	2.26	4.28	1.87	4.21	2.81	4.23
FEB	5.22	4.39	5.00	4.44	9.50	4.79	3.05	4.35
MAR	2.74	4.68	5.30	4.57	7.37	4.41	3.83	4.13
APR	2.80	4.36	4.54	4.27	5.24	4.31	3.35	4.31
MAY	4.07	4.36	8.52	4.25	3.64	4.08	3.76	4.17
JUN	8.78	4.65	2.62	4.31	8.56	4.31	6.76	4.48
JUL	4.92	4.27	5.75	4.35	4.27	4.20	3.93	4.12
AUG	1.28	4.24	1.27	4.08	0.04	3.64	0.40	4.28
SEP	0.93	4.08	1.77	4.08	0.80	3.93	1.75	3.93
OCT	3.15	4.36	3.44	4.30	4.76	4.22	5.05	4.26
NOV	4.02	4.76	3.16	4.76	1.64	4.56	1.65	4.88
DEC	3.03	4.42	3.45	4.32	4.85	4.32	1.57	4.25
# EVENTS	65		83		77		51	
TOT. PPT.	42.69		47.08		52.54		37.91	
TOTAL H+	0.001603		0.002196		0.002475		0.002134	
YR.WT.pH	4.43		4.33		4.23		4.25	

Table 17. Volume-Weighted pH and Precipitation (Inches) for Three Massachusetts NADP Monitoring Sites During 1984.

	QUABBIN		WALTHAM		TRURO	
MONTH	PPT	pH	PPT	pH	PPT	pH
JAN	1.88	4.29	2.06	4.42	3.95	4.42
FEB	6.14	4.53	7.82	4.62	4.61	4.79
MAR	3.60	3.84*	5.54	4.54	8.95	5.00
APR	4.19	4.50	3.96	4.45	4.56	4.76
MAY	13.29	4.51	3.43	4.21	3.96	4.40
JUN	3.52	4.14	7.53	4.38	7.04	4.92
JUL	5.13	4.42	4.50	4.46	6.43	4.87
AUG	3.03	4.17	3.55	4.01	0.89	4.36
SEP	4.16	4.25	2.52	4.47	6.04	4.38
OCT	1.71	4.55	1.60	4.15	1.96	4.36
NOV	3.03	4.59	3.60	4.66	0.95	4.65
DEC	4.16	4.25	3.60	4.38	3.68	4.54
TOT. PPT.	57.91		48.26		53.02	
YR.WT.pH	4.31		4.38		4.64	
w/March excluded	4.38		4.37		4.59	

* Power failure at site, only a fraction of precipitation collected

TABLE 18. Annual Volume-Weighted pH and Precipitation (Inches) for Four Massachusetts Event/Monitoring Sites.

	UNIV. MASS.		HOLY CROSS		SWAMPSCOTT		CARVER	
YEAR	PPT	pH	PPT	pH	PPT	pH	PPT	pH
1982	35.03	3.98[1]	40.75	4.29				
1983	64.97	4.24	59.50	4.33	49.92	4.43[1]	30.44	4.30[2]
1984	42.69	4.43	41.50	4.33	52.54	4.23	32.89	4.23

[1] 10 months of data

[2] April 10 - December only

TABLE 19. Annual Volume-Weighted pH and Precipitation (Inches) for Three Massachusetts NADP Sites.

	QUABBIN		WALTHAM		TRURO	
YEAR	PPT	pH	PPT	pH	PPT	pH
1982	39.58	4.36 [1]	37.82	4.33 [2]	53.07	4.42
1983	51.43	4.43 [2]	51.94	4.42	63.77	4.53
1984	51.91	4.31	48.26	4.38	53.02	4.64
		4.38 [3]				

[1] 10 months of data

[2] 11 months of data

[3] Annual weighted average pH with March 1984 excluded due to power failure.

Table 20. Annual Volume-Weighted Concentration (ueq/l) of Cations and Anions at Three Massachusetts NADP Sites during 1984.

	Quabbin [1]	Waltham	Truro
Ca^{++}	6.35	3.96	8.07
Mg^{++}	3.71	4.19	27.86
K^{+}	0.99	0.58	2.91
Na^{+}	7.80	13.33	120.08
NH_4^{+}	11.24	6.43	5.91
NO_3^{-}	30.17	13.33	11.76
Cl^{-}	10.01	18.20	144.97
SO_4^{--}	44.18	39.03	36.86
PO_4	0.12	0.10	0.12
H^{+}	48.51	41.26	23.05
pH	4.31	4.38	4.64

[1] Due to power failure not all precipitation which fell during March was collected.

TABLE 21. Average Monthly Volume-Weighted Concentrations of Sulfate Corrected for Contributions by Seaspray (Total sulfate - Contribution from Seaspray) and Percent Donated by Seaspray.

	QUABBIN		WALTHAM		TRURO	
	Corrected SO_4^{--}	Percent Donated SO_4^{--}	Corrected SO_4^{--}	Percent Donated SO_4^{--}	Corrected SO_4^{--}	Percent Donated SO_4^{--}
JAN	30.22	5.3	20.82	6.9	30.77	23.3
FEB	24.50	5.3	27.22	6.2	18.50	21.3
MAR	88.11*	1.0	28.13	5.4	14.57	78.1
APR	30.17	3.1	35.49	5.5	20.00	28.4
MAY	28.62	2.1	55.40	1.2	45.10	5.0
JUN	82.95	0.8	33.26	4.9	13.30	17.9
JUL	32.62	1.7	28.76	4.5	11.81	20.3
AUG	61.63	0.5	93.68	0.6	63.37	4.9
SEP	64.50	0.9	30.31	3.9	32.91	29.4
OCT	60.47	1.1	50.96	0.8	27.19	3.0
NOV	39.60	5.1	24.27	15.2	15.33	35.4
DEC	48.74	2.0	39.38	4.0	24.85	39.0
Annual Wted. Avg.	43.24		37.43		22.45	

* Due to power failure not all precipitation which fell during March was collected.

Table 22. Average (± Std. Dev.) Monthly Deposition (mg/m^2) of Cations and Anions at Three Massachusetts NADP Sites for 1984.

	Quabbin [1]		Waltham		Truro	
Ca^{++}	8.46	(4.95)	7.93	(4.19)	14.83	(19.11)
Mg^{++}	3.30	(2.18)	5.15	(2.86)	30.48	(55.75)
K^{+}	3.04	(3.47)	2.27	(1.23)	10.28	(17.59)
Na^{+}	14.21	(12.60)	30.73	(20.36)	247.82	(466.13)
NH_4^{+}	16.16	(14.55)	11.91	(10.39)	10.60	(7.68)
NO_3^{-}	131.91	(84.36)	95.10	(52.03)	70.74	(33.67)
Cl^{-}	27.75	(22.43)	65.17	(39.44)	460.86	(881.28)
SO_4^{--}	164.93	(112.78)	190.79	(105.55)	167.68	(139.31)
PO_4	0.31	(0.34)	0.32	(0.16)	0.37	(0.23)
H^{+}	3.60	(2.34)	4.23	(2.30)	2.28	(1.50)

[1] Due to power failure not all precipitation which fell during March was collected.

Table 23. Total Annual Wet Deposition (mg/m^2) of Cations and Anions at Three Massachusetts NADP Sites for 1984.

	Quabbin [1]	Waltham	Truro
Ca^{++}	101.53	95.20	177.98
Mg^{++}	39.54	61.75	365.71
K^{+}	36.48	27.24	123.34
Na^{+}	170.55	368.81	2973.78
NH_4^{+}	193.87	142.86	127.16
NO_3^{-}	1582.94	1141.15	848.84
Cl^{-}	332.94	781.98	5530.29
SO_4^{--}	1979.18	2289.44	2012.21
PO_4	3.73	3.84	4.47
H^{+}	43.20	50.72	27.39

[1] Due to power failure not all precipitation which fell during March was collected.

Table 24. Total Annual Wet Deposition (kg ha^{-1} yr^{-1}) of Sulfate and Nitrate at Three Massachusetts NADP Sites for 1982 - 1984.

	Quabbin	Waltham	Truro
		1984	
SO_4^{--}	19.79	22.89	20.12
NO_3^-	15.83	11.41	8.48
TOTAL	35.62	34.30	28.60
		1983	
SO_4^{--}	23.80	23.70	27.10
NO_3^-	14.70	10.50	11.70
TOTAL	38.50	34.20	38.80
		1982	
SO_4^{--}	23.43	21.10	21.60
NO_3^-	14.70	10.50	10.30
TOTAL	38.13	31.60	31.90

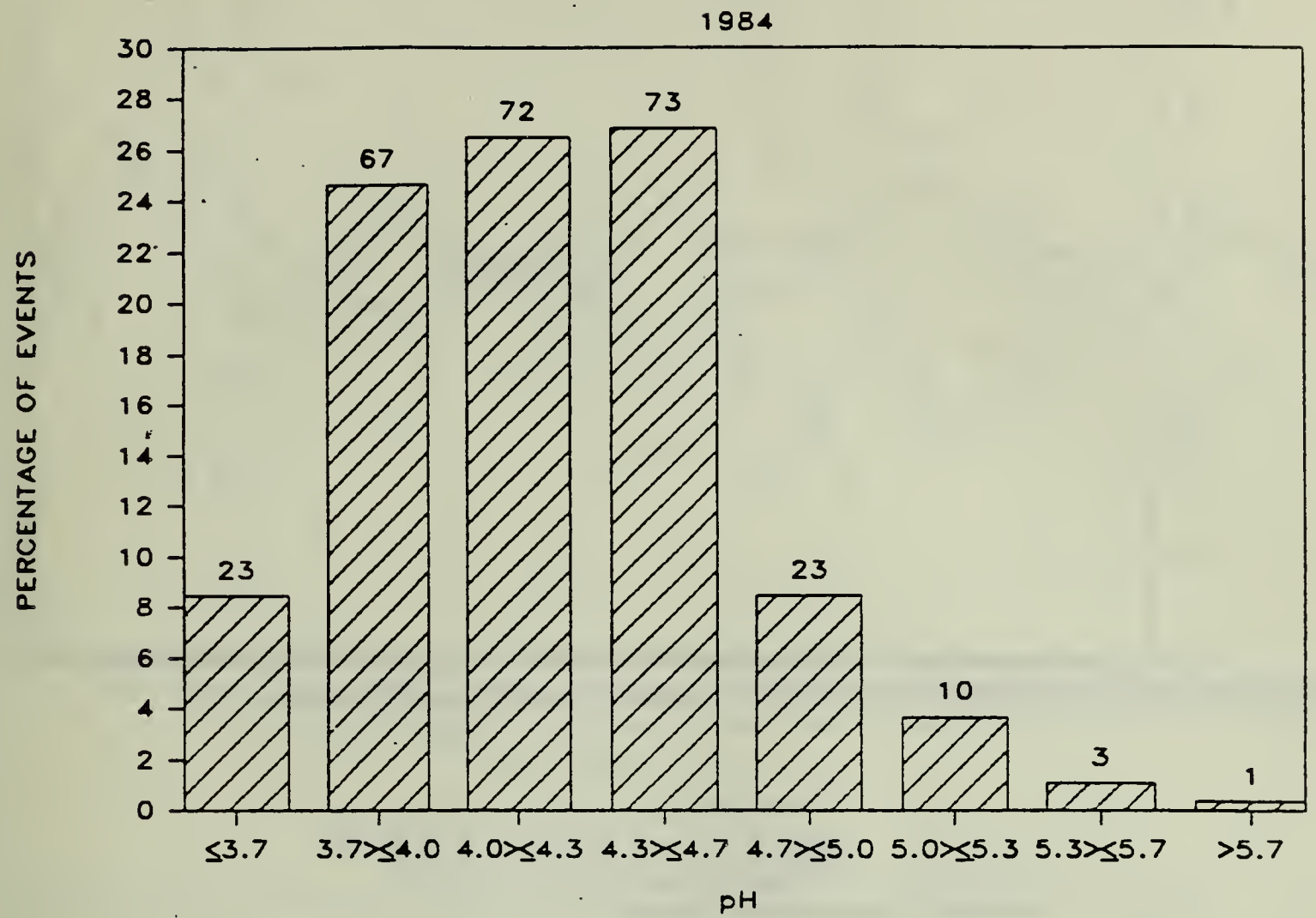
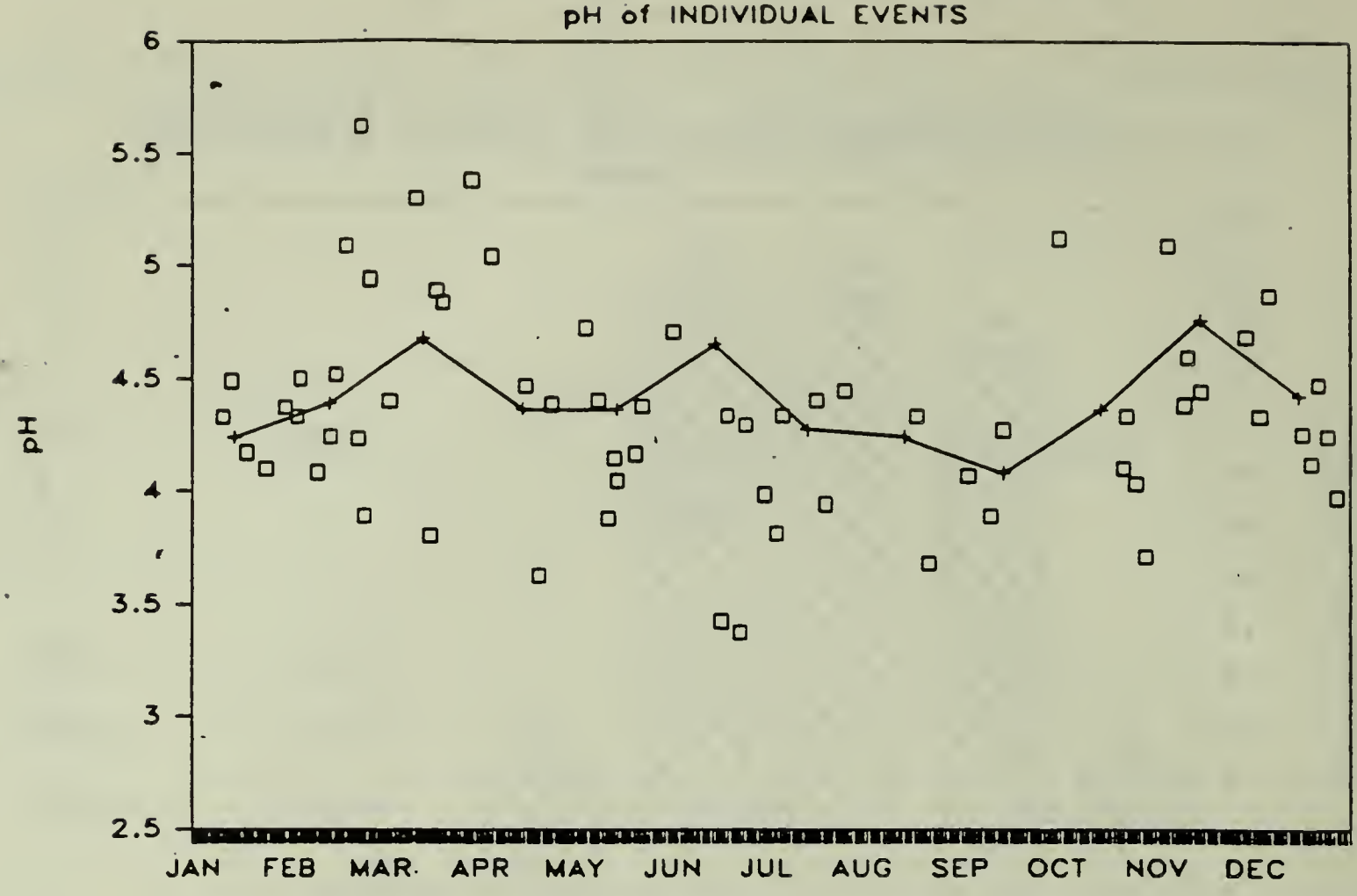


Figure 14 The distribution of precipitation events into pH categories at four Massachusetts event monitoring sites.



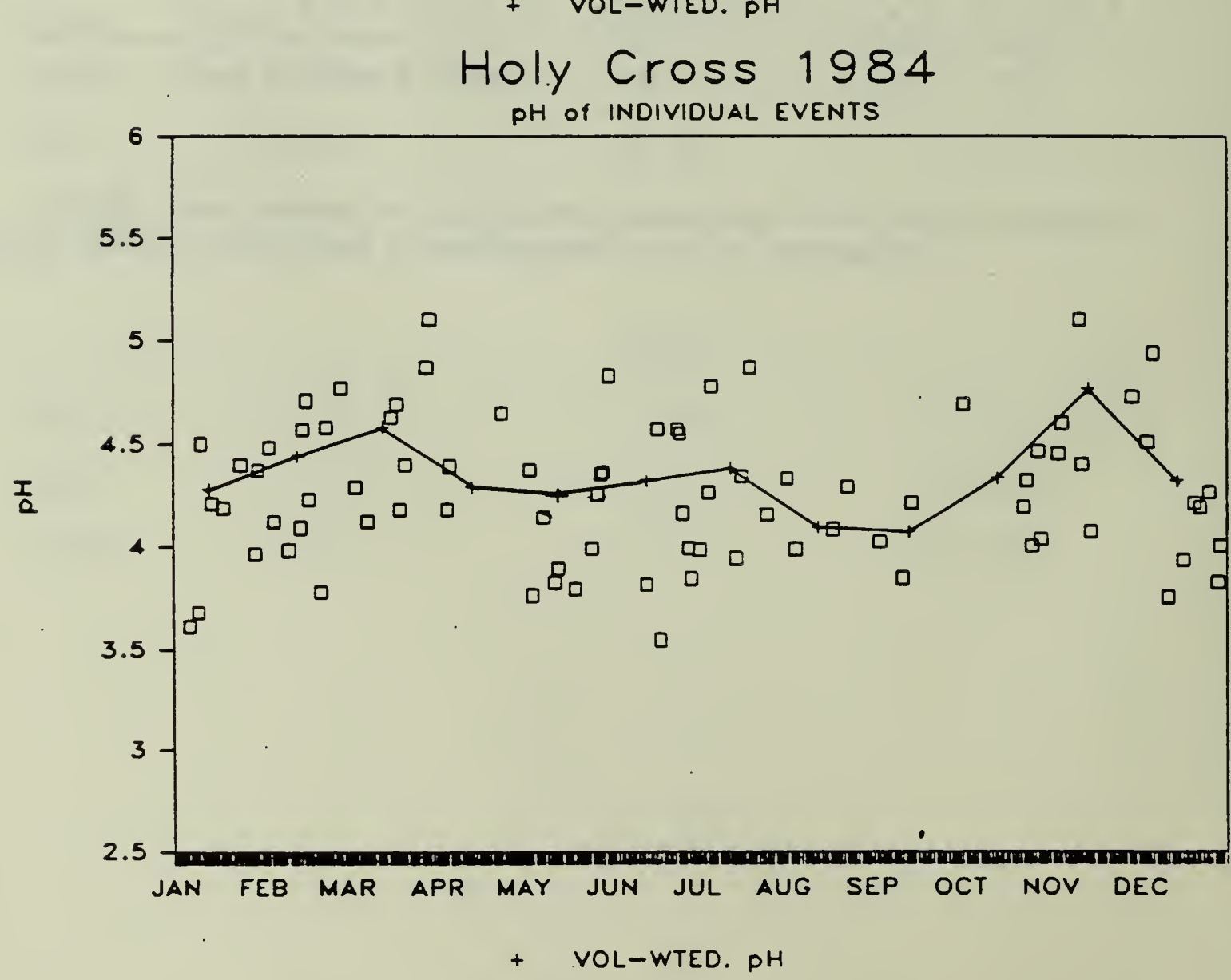


Figure 15. The pH of individual events and the monthly volume-weighted pH at the University of Massachusetts (top) and The College of Holy Cross (bottom).

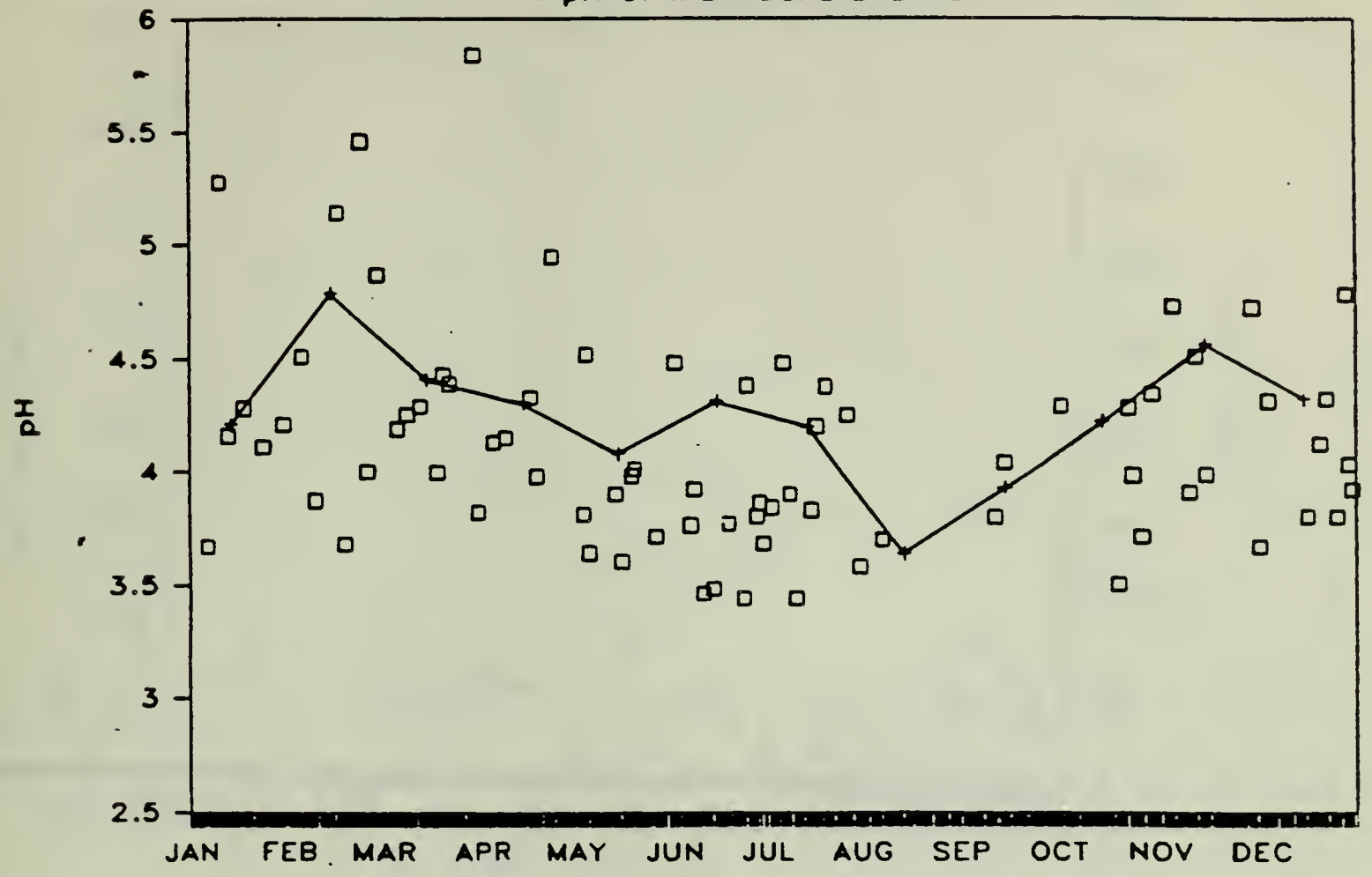
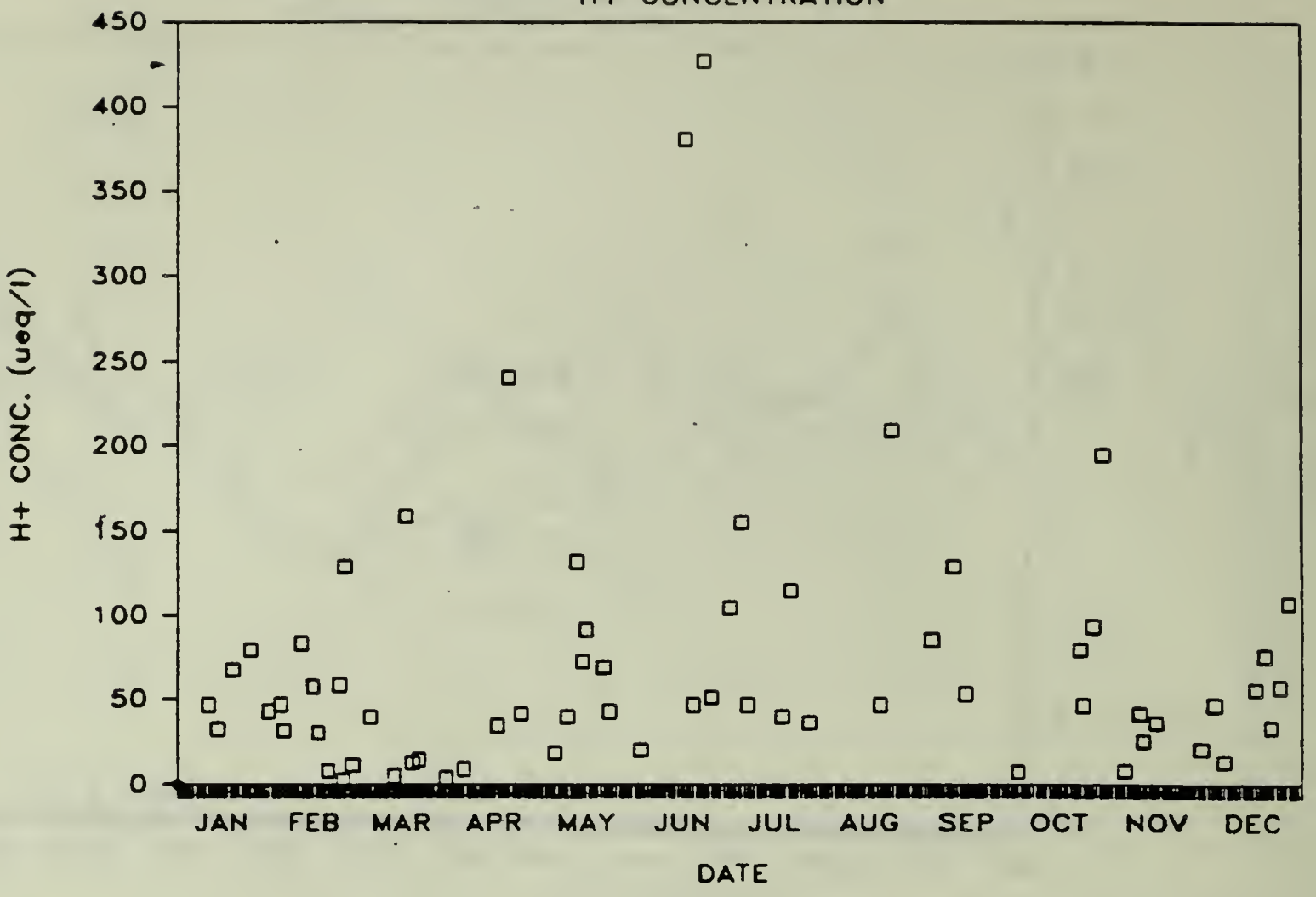


Figure 16. The pH of individual events and the monthly volume-weighted pH at Swampscott (top) and Carver (bottom).



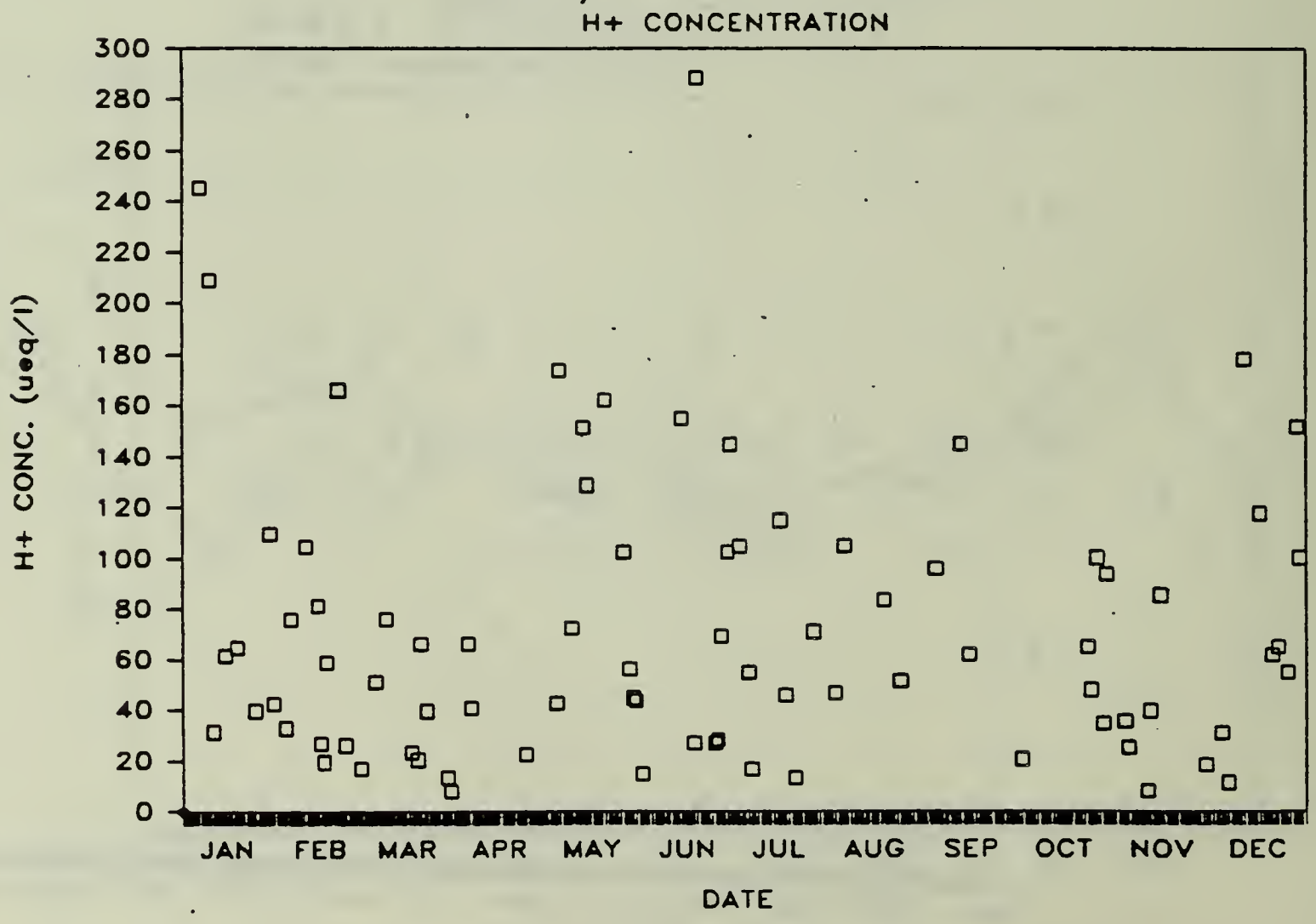
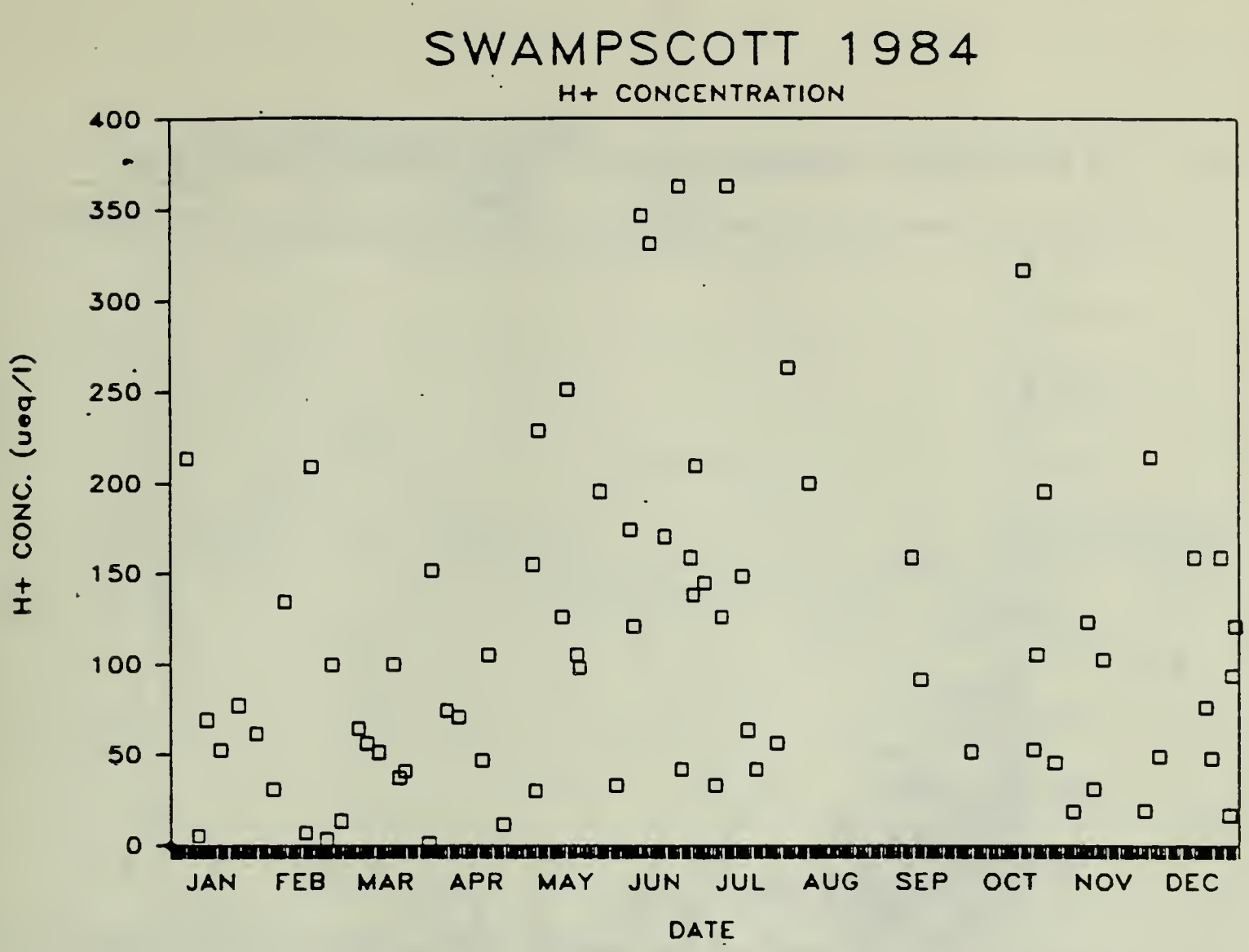


Figure 17. The hydrogen ion concentration of individual events at the University of Massachusetts (top) and The College of Holy Cross (bottom).



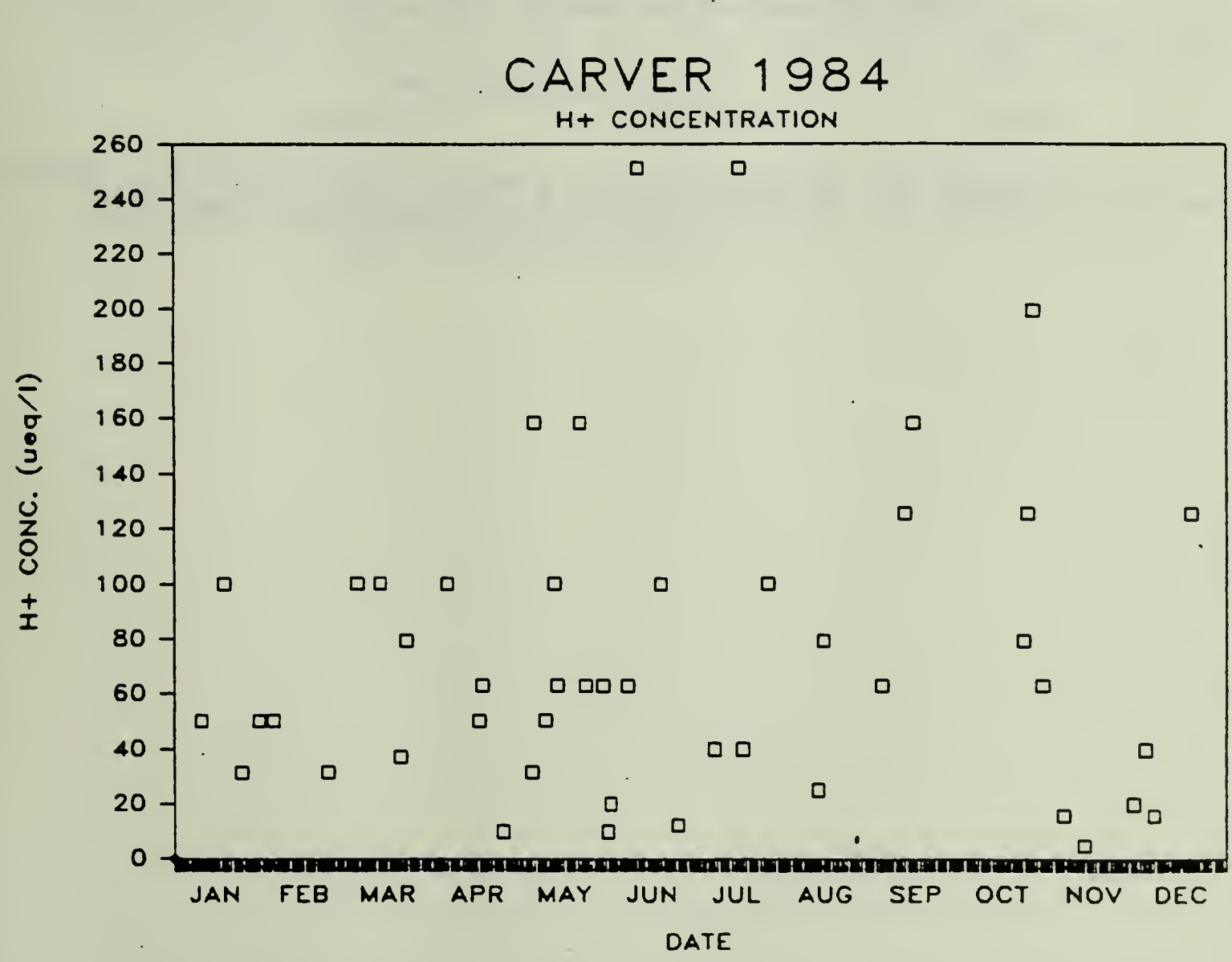


Figure 18. The hydrogen ion concentration of individual events at Swampscott (top) and Carver (bottom).

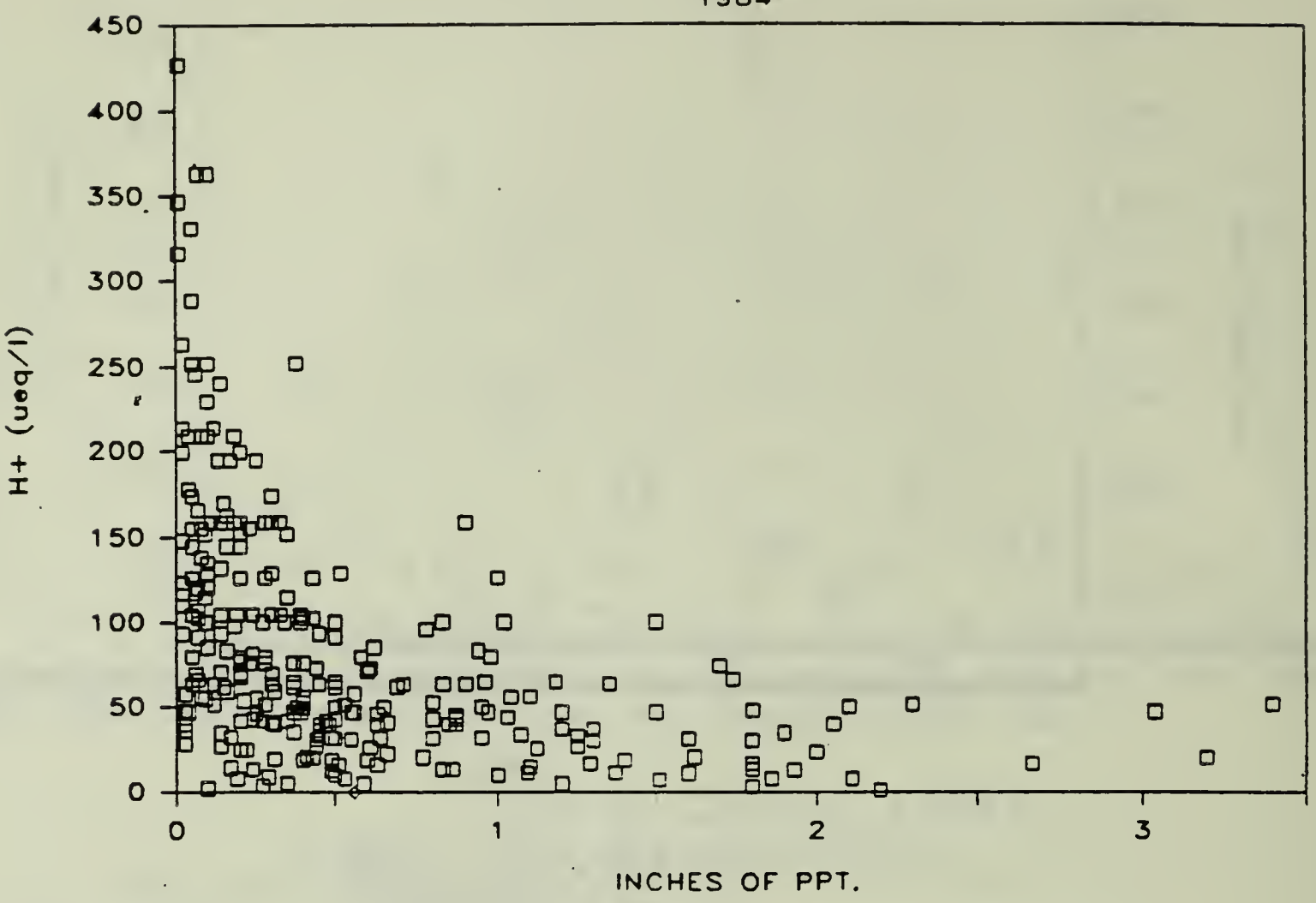


Figure 19. Hydrogen ion vs. precipitation volume for events at the four event monitoring sites during 1984.

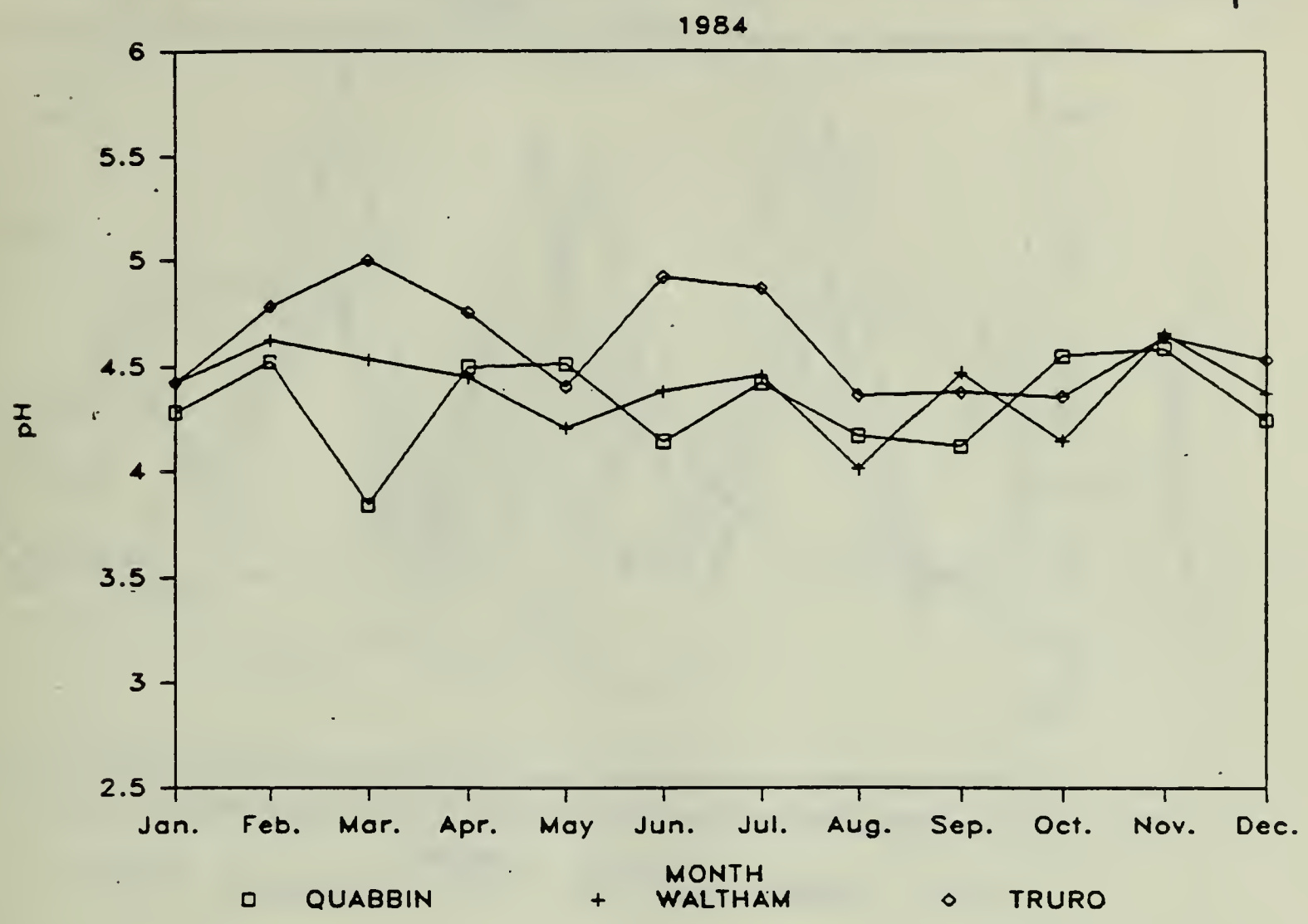


Figure 20. The monthly volume-weighted pH for three Massachusetts NADP monitoring sites.

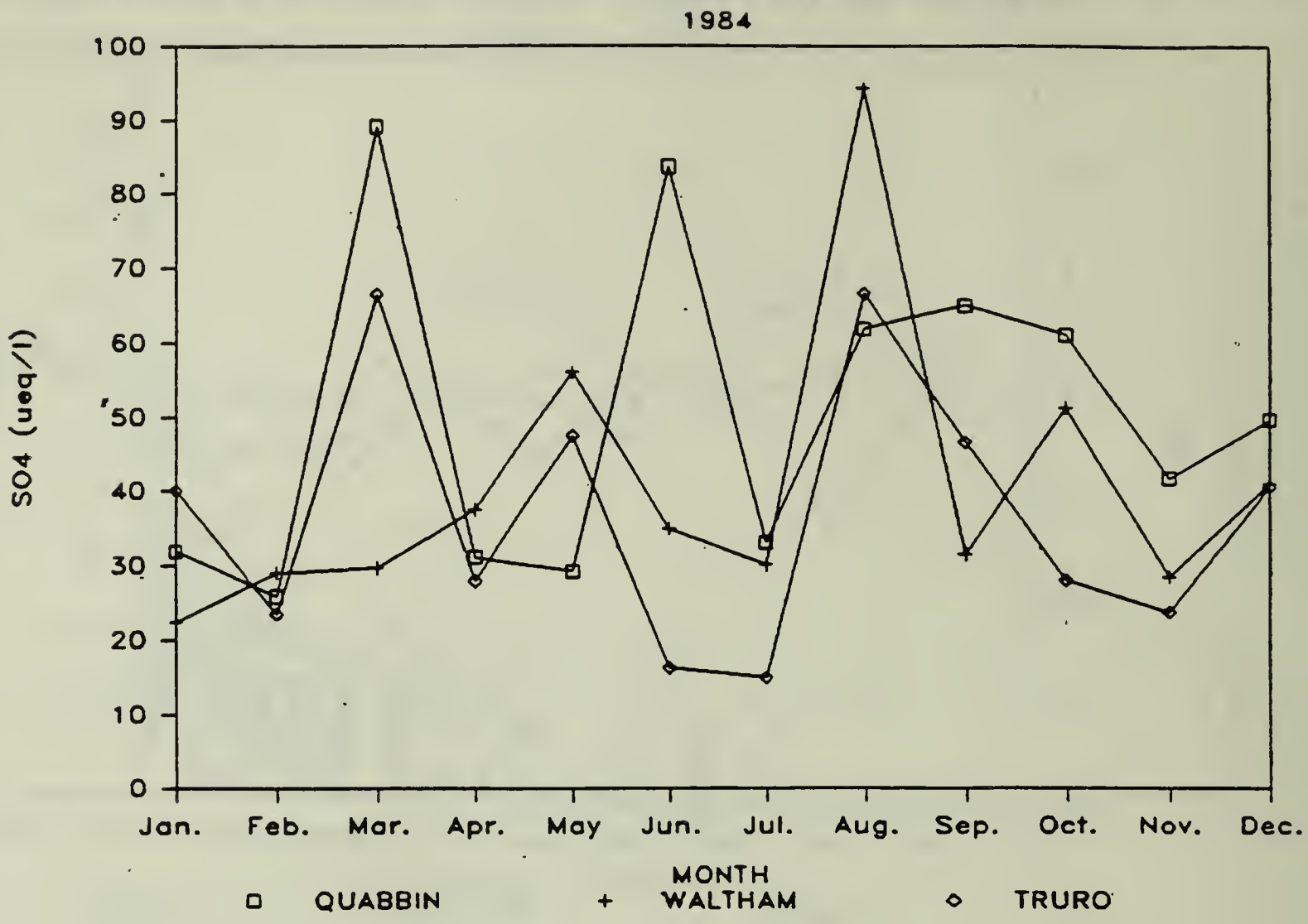


Figure 21. The monthly volume-weighted sulfate concentrations for three Massachusetts NADP monitoring sites.

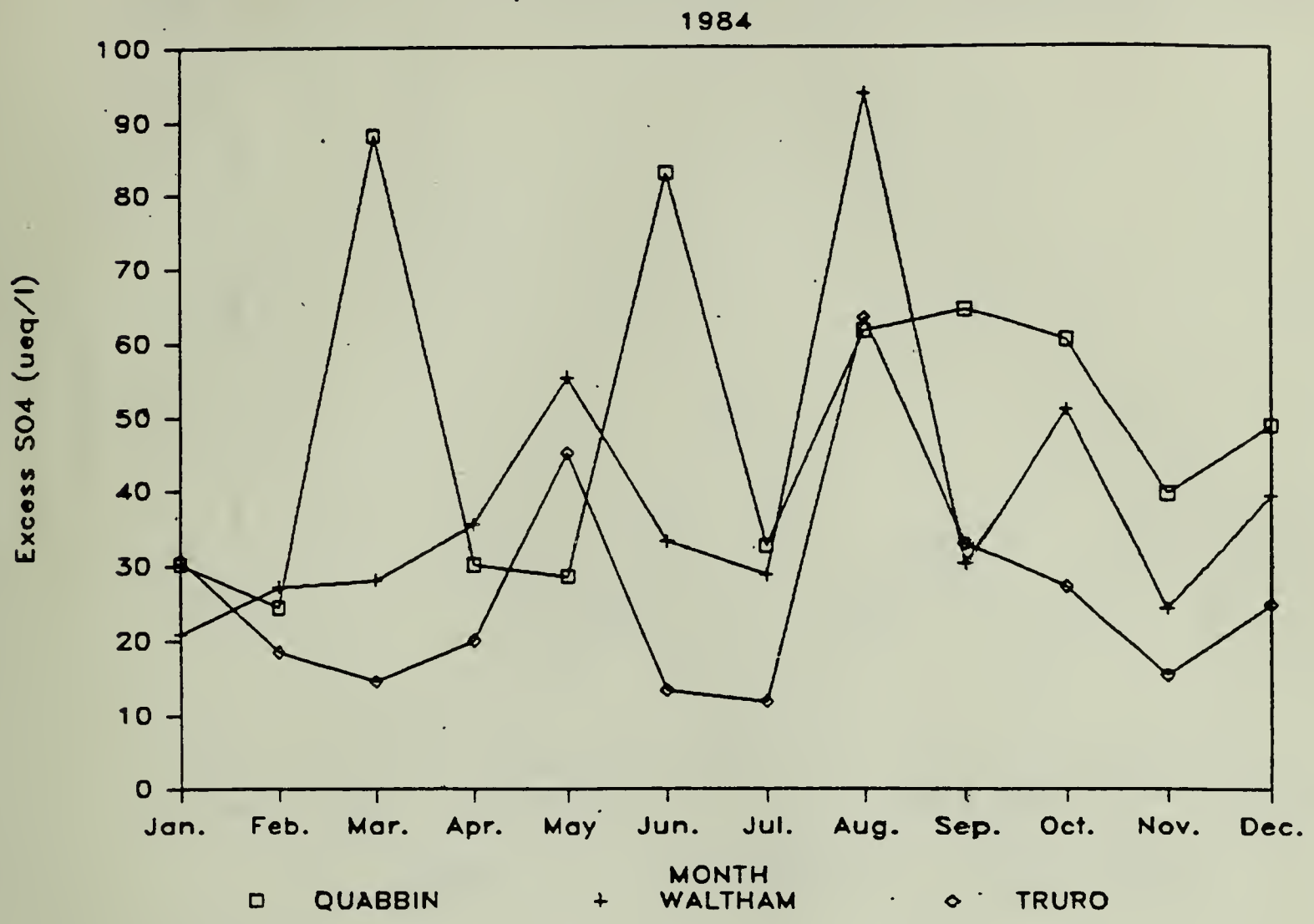


Figure 22: The corrected monthly volume-weighted sulfate concentrations for three Massachusetts NADP monitoring sites.

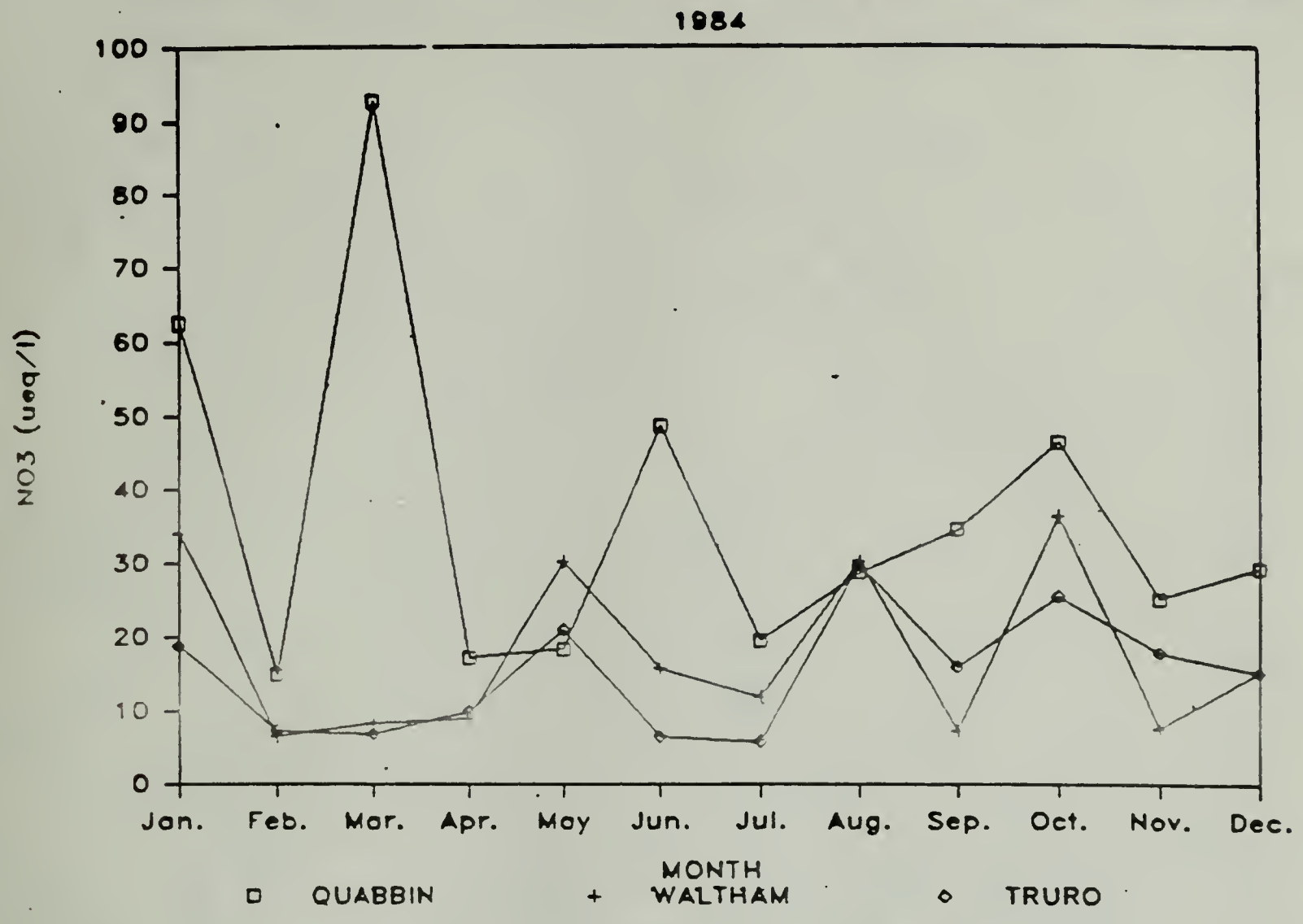


Figure 23. The monthly volume-weighted nitrate concentrations for three Massachusetts NADP monitoring sites.